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California State University
San Bernardino

MATH LESSONS FOR
FONTANA HIGH SCHOOL SOFTWARE

A Project Submitted to
The Faculty of the School of Education
In Partial Fulfillment of the Requirements of the
Degree of

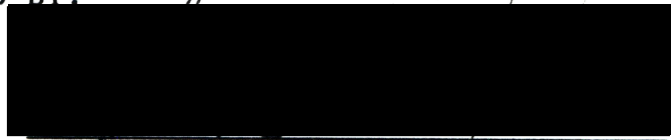
Master of Arts
in
Education: Secondary Option

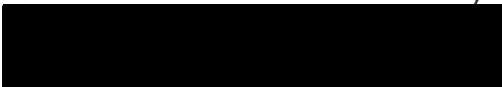
By

Cynthia Vanderwilt Barkley
San Bernardino, California

1994

APPROVED BY:


Advisor: Dr. Irvin Howard


Second Reader: Dr. Susan Cooper

Abstract

With the prolific use of computers in today's society, it would be a surprise to find that computers are sitting idle in some places. Yet at Fontana High School they are. Teachers may not have the experience to use the computers, they may not be aware that the software exists, or they may not know in which courses to use the software. Whatever the reason, students should be using computers if they are available.

Using computers as part of instruction has been found to be beneficial in numerous ways. These benefits include improvement of student attitudes toward computers and subject matter, increased test scores, and less time needed to learn. Cooperation among students and students being an active part of their own learning can also be results of using computers in instruction.

This paper includes 23 lessons for seven different mathematics software packages and teacher information sheets that describe reading levels, objectives, and detailed instructions about each lesson. Each lesson lists the courses in which the lesson might be used and the prerequisites necessary to use it. With this project teachers should be able to select lessons that will fit some part of the curriculum for their courses.

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Math Lessons for Fontana High School Software

Introduction

Computers have been a growing part of education over the last two decades. Some schools have computer proficiency skills students demonstrate before graduation. As yet, computer literacy or competency standards have not resulted in graduation requirements at Fontana High School. Whether requirements are in place or not, educators need to give students the exposure to computers necessary for them to succeed beyond high school.

"Instructional computing" is defined as any application of a computer that helps teachers teach and learners learn (Camp & Marchiononi, 1981). Some common types of instructional computing include, but are not limited to, computer-assisted-instruction (CAI) or computer-assisted-learning (CAL), computer-based-instruction (CBI), and computer-enhanced-instruction (CEI). Each of these "involves opportunities to use computer programs as effective tools... for initial teaching, drill and practice, inquiry, problem solving, tutoring for remediation, enrichment, and learning reinforcement..." (Anderson, 1987, p. 8). Computer literacy involves abilities far beyond the computer experiences of students in any given math class. It is not the purpose of

this project to make students computer literate through the use of computers; the intent is to give teachers the opportunity, through instructional computing, to help students become competent in the basic skills of computer use.

Statement of the Problem

The availability of computers does not necessarily mean computers will be used. Compatible software to a subject's curriculum also must be available. In the Fontana High School Math Department's case, computers and software abound but teachers' enthusiasm does not. Teacher readiness comes from teacher education, training, and easy to use software. Even when teachers are trained and prepared, the software remains difficult to integrate. The documentation provided with software is often too descriptive or not descriptive enough. In order to help teachers integrate computers into their classrooms, specific lessons and directions need to be provided with the software, as well as information about classes in which it can be utilized.

Objective

Only a few of the math teachers at Fontana High School use any of the available software to assist them in teaching their subject. The lesson plans created for this project will allow teachers with little or no computer experience to take any or all of their math classes to the computer lab. It is my hope that after teachers gain experience in the computer lab, they can create their own lessons for continued implementation of the software.

Review of the Literature

Teacher Experience

Computer assisted instruction (CAI) may not be implemented into many classes because some educators experience computer anxiety. Just as some people suffer from math anxiety or test anxiety, people may suffer from computer anxiety. According to Small and Haley (1986), computer anxiety exists when "a level of fear or apprehension [is] felt by an individual either confronting, or thinking about confronting, a computer" (p. 1).

To overcome the anxiety caused by computers, teachers need to be exposed to computers and trained in their use. A high priority in training teachers to use computers in the classroom is to offer hands on experience for them. While the most effective training to offer teachers would be through inservice training, any kind of training would be helpful. Giannelli (1985) points out that ignorance and fear are the major reasons for teachers' reluctance to get involved with computers. Demonstrating how to load and run software and explaining to teachers that they do not need to know programming may help teachers to incorporate computer use into classrooms.

When teachers have the proper experience to use computers in their classrooms, the problem of adequate and/or appropriate software may arise. Two major problems

related to software are: (1) software which is written at a level students cannot understand or translate, and (2) existing software which does not fit the existing curriculum. Most software programs are well-documented and include a manual with directions for teachers on usability, but it may be difficult for teachers to fit these programs into their curriculum plans. If lessons for software were provided for specific courses, and detailed directions included, maybe teachers would be more likely to use computers in their teaching. Some types of available instructional software can be described as drill and practice (Interpreting Graphs), tutorials (Graphing Equations), games (Royal Rules, Building Perspective), simulations (The Factory), and discovery (Logo, Geometric Supposer). The limiting of the software to these types in this review is due to the limit of available software at the author's school site.

Drill and practice programs give learners the opportunity to exercise and reinforce previously learned skills, concepts, and techniques (Anderson, 1987). Tutorials provide new information on a concept or topic (Anderson). Instructional games are designed to make drill and practice less tedious or to hold a user's interest while teaching a concept (Anderson). Simulations educate by illustration or model of real-life situations (Tinker, 1984). Discovery programs "develop cognitive problem-solving abilities in

specific subject areas..." (Anderson, p. 9). Drill and practice programs as well as games and simulations should be used as a supplement to traditional instruction, while tutorial and discovery programs may be supplemental or used as the entire instruction which includes practice and evaluation of concepts.

A few types of software such as Logo and Geometric Supposer are designed to allow teachers to make lessons that will encourage students to learn certain mathematical concepts and processes through exploration (Battista, 1988). While this type of software may be considered discovery, students need to work on teacher devised tasks designed for specific learning outcomes (Hoyles & Sutherland, 1989). Teachers must prepare interactive activities for students with limited experience and for students to be introduced to new and powerful ideas (Kenney, 1987; Hoyles & Sutherland).

As students are exposed to computer work, their views of the concepts, strategies, and procedures of math will grow as well as their ability to learn from and work with their peers (Heid, Sheets, & Matras, 1990). Students need to learn to be independent learners from teachers while teachers need to learn to act as guides and facilitators (Hoyles & Sutherland, 1989). Ideally, as Pulaski (1980) writes, the teacher should not be there to demonstrate or lecture, but to observe and question. It is hopeful that once teachers gain experience

with the use of computers they will modify their teaching to incorporate computers as learning tools in more of their courses (Lynch, Fischer, & Green, 1989).

CAI Effectiveness

Many studies in this review of the literature do not elaborate on the type of CAI being tested. Varnhagen and Zumbo (1990) report a study of college statistics classes and the use of simulation CAI and drill and practice CAI. Results indicate that while neither type of CAI had an effect on student performance, they did have a positive effect on student attitude toward instruction. Varnhagen and Zumbo conclude that technical courses such as statistics should be supplemented with CAI to enhance the learning experience of students. In a similar study of college statistics by Marcoulides (1990), results indicate that drill and practice CAI used as an aid to instruction improved students' performance by means of higher test scores. Students using supplemental CAI benefited more than students just receiving lectures.

Geometric Supposer is a type of software that uses guided inquiry to help students learn to think from specific terms to general concepts and from conjecture to proof (Yerushalmy, Chazan, & Gordon, 1987). It was designed to allow students to gather data, make a hypothesis, test a hypothesis, state a conclusion as a theorem with a proof, or

reject a hypothesis with counter examples (Chazan, 1990). Yerushalmy, Chazan, & Gordon conducted a study on the Geometric Supposer using three geometry classes, totalling 44 students at different high schools. According to the authors, Supposer students "outperformed the comparison group in their ability to develop generalizations, and they were equal to and/or somewhat better ... in their ability to devise informal arguments and traditional formal proofs" (Yerushalmy, Chazan, & Gordon, p. 68). Cooperation and an appreciation for working with others in the experimental group were also observed. One of the only negative items observed in this study is that teachers had to spend several hours a week (up to ten) working with the software and working on problems. The amount of time needed decreased over the year but clearly it would be difficult to integrate this software if teachers do not have the time to prepare.

From interviews with teachers and examination of software, Tinker (1984) indicates that "software can improve learning, lead to greater achievement on the part of students, improve teacher productivity, and reduce costs" (p. 1). In reviewing studies on CAI effectiveness, Tinker found that achievement gains were substantial for CAI use, either as a supplement to traditional methods or by itself. Students with CAI experience liked the materials better, showed more interest in mathematics and displayed increased

motivation toward learning. It was also reported that CAI decreases the time needed for instruction and improved school attendance.

Conclusions made by Bennett (1991) in a summary of 15 years of major research reviews parallel many of the findings of CAI effectiveness in the teaching of secondary mathematics. The greatest positive effect on learning mathematics was with tutorial CAI, but all types of CAI were found effective. Student achievement increases when computers supplement instruction. Positive attitudes of students toward computers increases but attitudes toward the subject may not improve. Bennett also concludes that students need less time to learn material when instruction is aided by the computer.

A variation of CAI, computer-enhanced-instruction (CEI), relies more on the graphics capabilities of the computer. Kiser (1989) lists several reasons to integrate CEI into mathematics instruction. CEI may: "(1) deepen understanding and motivation to learn traditional topics; (2) improve student attitudes toward the computer and toward learning mathematics in general; (3) decrease the time to unit mastery and/or increase retention rate..." (p. 40).

One CEI example is Logo, a programming language designed to make it easy for students to communicate with the computer using simple English commands (Papert, 1980). Seymour

Papert. Logo's creator, believes that what and how a student learns depends on the models available. By learning to program with Logo the process of learning is more active and self-directed and students therefore acquire knowledge for their own purpose (Papert). Working with computers, and Logo in particular, promotes talking and listening among students, which generates cooperation and increased understanding (Hoyles & Sutherland, 1989). In summary, Logo promotes learning through discovery and teacher directed activities, develops problem solving skills and supports the teaching of geometry by making it come alive (Kenney, 1987).

Explorations with Logo help students learn the logical process to put geometrical shapes on the screen. In one study, Kiser (1989) reports on the investigation of the effectiveness of Logo's turtle graphics in which the CEI group of second graders showed more understanding of geometry thinking skills than the traditional group of second graders. Two separate studies of fourth graders suggest that use of Logo activities promotes reflective thinking (Gallini, 1987) and "has potential for improving children's normal school learning of geometric ideas" (Clements & Battista, 1990, p. 370).

Additional factors attributed to students' positive attitudes to CAI are that computers offer nonjudgemental feedback, computers do not get frustrated or angry, and

students feel they learn better. Dalton and Hannafin (1984) found in their study of eighth grade remedial math students, that computer self-esteem scores showed improvement for all groups. This indicates that exposure to instructional computing improves students' attitudes toward CAI. A study that supports this claim compared the effects of CAI and traditional instruction on computation accuracy. Dalton and Hannafin (1988) found more favorable attitudes by students receiving initial computer-based instruction than those receiving initial teacher instruction. The authors report that the positive attitude may be due to the novelty effect computers have on students.

Why CAI?

Why should educators implement CAI? In addition to preparing students for computer competency, motivating students to learn is important. CAI has been shown to be effective because of its motivating abilities. Bell (1978) summarizes the effectiveness by describing the five areas of the motivation to learn as:

- (1) internal personal satisfaction in one's accomplishment,
- (2) external rewards and recognition for work well done,
- (3) a seemingly inherent desire to be able to make things work,
- (4) a drive to create things,
- and (5) a need to have some significant control over the learning situation (p. 431).

CAI provides fulfillment in each of these five areas.

According to Piaget (1976) children develop reasoning through their play, verbal use, and by observation. In other words, children must have experiences to intellectually move from concrete operational thought to formal operational thought. It is not enough to allow children to sit passively to learn, they must be allowed to actively participate in their learning. As Piaget states, "if a child is interested in what he does he is capable of making efforts to the limit of his physical endurance" (Piaget, 1965, p. 365). Use of computer software may be one way to get that interest.

Computer programs may also help students develop and practice Polya's (1945) four phases of problem solving as they understand the problem, devise a plan, carry out a plan, and look back. Interaction with Building Perspective, The Factory, and The Royal Rules allows students to work through these phases. Students trying to draw a house with the Logo turtle must conjecture, test, and debug (Hoyles & Sutherland, 1989). Trial and error can be a great motivating factor in students' desire to learn. Whether students are drawing hexagons on the screen with Logo, constructing obtuse scalene triangles using the Geometric Supposer, or plotting points to catch the robbers in Escape, students are active; students are thinking. By allowing interacting with computers,

educators will find students eager to be involved with learning.

Project Description

Most of the software in the math department is published by Sunburst Communications. Lessons for INTERPRETING GRAPHS, GREEN GLOBS and GRAPHING EQUATIONS, THE ROYAL RULES, THE FACTORY: EXPLORATIONS IN PROBLEM SOLVING, BUILDING PERSPECTIVE: STRATEGIES IN PROBLEM SOLVING, and GEOMETRIC SUPPOSER: TRIANGLES are part of this project. At least two lessons are provided for each program. Lessons for use with LOGOWRITER are also included.

Each program is listed in the table of contents with identification of the target audience (ie. Math A, Math B, Math C, Algebra 1 or 2, Geometry). This part of the documentation lists the prerequisite skills and mathematical knowledge necessary of students for each lesson. Also included on this page are the number of minutes required for each lesson and the total number of sessions required to complete the software program. Complete directions on how to turn the computers on and how to get the lesson started are provided for the teachers.

PROJECT ACTIVITIES AND MATERIALS

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General Information.....	19
How to use the Math 2 Room 4 Computer Lab.....	21
How to use the Library Computer Lab.....	23
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Course Descriptions.....	26
Software References.....	28

SOFTWARE LESSONS

LOGOWRITER

Classes: Math A, Math B, Math C, Algebra 1, Geometry.

Teacher Information29

Lesson 1 (LW 1).....32

Prerequisite: none
Time: 30-50 minutes

Lesson 2 (LW 2).....34

Prerequisite: LW 1 and know the properties of
squares.
Time: 30-50 minutes

Lesson 3 (LW 3).....36

Prerequisites: LW 1, LW 2, and know:
properties of squares,
properties of parallelograms,
properties of triangles, and
definition of exterior angle.
Time: 45-55 minutes.

Lesson 4 (LW 4).....38

Prerequisites: Same as LW 3.
Time: 45- 55 minutes.

Lesson 5 (LW 5).....40

Prerequisites: Same as LW 3 and know the properties
of regular polygons.
Time: 45-55 minutes.

SOFTWARE LESSONS (continued)

LOGOWRITER

PAGE

<u>Lesson 6 (LW 6)</u>	42
------------------------------	----

Prerequisites: Same as LW 5.
Time: 45-55 minutes.

BUILDING PERSPECTIVE

Classes: Math A, B, C, Algebra 1 & 2, Geometry.

Teacher information.....	44
--------------------------	----

<u>Lesson 1 (BP 1)</u>	45
------------------------------	----

Prerequisite: none
Time: 25-50 minutes.

<u>Lesson 2 (BP 2)</u>	47
------------------------------	----

Prerequisite: BP 1
Time: 25-50 minutes.

THE ROYAL RULES

Classes: Math B, C, Algebra 1 & 2, Geometry.

Teacher information.....	49
--------------------------	----

<u>Lesson 1 (RR 1) "The City"</u>	51
---	----

Prerequisite: Know what square and square root means.
Time: 25-45 minutes.

<u>Lesson 2 (RR 2) "The Duchy"</u>	53
--	----

Prerequisite: RR 1 understand use of formulas.
Time: 25-45 minutes.

<u>Lesson 3 (RR 3) "The Province"</u>	55
---	----

Prerequisite: RR 1.
Time: 25-45 minutes.

<u>Lesson 4 (RR 4) "The Kingdom"</u>	57
--	----

Prerequisite: RR 1, RR 2, RR 3. (very difficult)
Time: 25-45 minutes.

SOFTWARE LESSONS (continued)

GREEN GLOBS and GRAPHING EQUATIONS

PAGE

Classes: Math C, Algebra 1 & 2, Geometry.

Teacher information.....59

Lesson 1 Graphing lines.....60Prerequisite: Know definition of constant,
coordinates, x and y axes.

Time: 45-55 minutes.

Lesson 2 Graphing parabolas.....63

Prerequisite: Same as Lesson 1.

Time: 45-55 minutes.

Lesson 3 Graphing circles.....65Prerequisite: Same as Lesson 1 and know
definition of radius and center.

Time: 45-55 minutes.

Lesson 4 Green Globbs.....68Prerequisite: Helpful to know equations of lines
and circles but not necessary.

Time: 20-50 minutes.

THE FACTORY

Classes: Math A, B, C, Algebra, Geometry.

Teacher information.....69

Lesson 1 Testing a Machine.....70

Prerequisite: none

Time: 30-50 minutes.

Lesson 2 Building a Factory.....71

Prerequisite: Lesson 1

Time: 30-50 minutes.

Lesson 3 Make a Product.....73

Prerequisite: Lesson 1

Time: 30-50 minutes.

SOFTWARE LESSONS (continued)

INTERPRETING GRAPHS

PAGE

Classes: Math B, C, Algebra 1 & 2, Geometry.

Teacher information.....75

Lesson 1 Interpreting Graphs.....76

Prerequisite: none

Time: 20-30 minutes.

Lesson 2 Escape.....78Prerequisite: Know how to plot points on coordinate
axes and know difference between
vertical and horizontal.

Time: 20-50 minutes.

GEOMETRIC SUPPOSER: TRIANGLES

Classes: Math B, Geometry.

Teacher information.....79

Lesson 180Prerequisite: Know how to identify angles of a
triangle with three letters and know
how to identify sides of a triangle
with two letters.

Time: 15-45 minutes.

Lesson 281


Prerequisite: Lesson 1

Time: 40-55 minutes.

General Information

These lessons are for the software found in the Mathematics Department at Fontana High School. Much of the software has been in the department for several years and very few teachers use it. The purpose of writing these lessons is to give teachers the opportunity to look through them and possibly find something to use for their classes. Once anyone uses these programs I encourage them to make their own lessons. I recommend that teachers try these lessons themselves before they try them with a class to determine which lessons might work for them.

About the lessons:

All lessons are designed for students to work in pairs at the computer. Rarely are there enough computers for students to work individually but most lessons adapt well to individual work. Unless "LogoWriter Lesson 1" is used, students will need to be told that the words **Enter** and **Return** mean "press the  button".

Information about the lessons for each type of software is contained on the teacher information sheet. This information includes reading level, objectives, descriptions of each lesson, and when necessary, an example. The time needed and any prerequisite knowledge of students is included in the Table of Contents.

An evaluation form is included. Please feel free to copy it, fill it out, and return it to Cindy Barkley. Suggestions are welcome so that these lessons might be improved.

About the computer labs:

There are two computer labs available for math use. One is located in the library and must be reserved through the librarian. The other is in Math 2 Room 4 and can be reserved by talking to Dave Fischer. Computer classes are taught in the lab in Math 2 Room 4 so there may be periods that it will not be available. Both labs have 20 IBM Compatible computers with 640 K memory and color graphics capabilities. Please let the librarian or Dave Fischer know if any of the computers are not functioning properly.

Information on how to start the computers is provided for each lab following these general information pages.

About the software packages:

We have a site license for LogoWriter and there are 20 disks. If you would like to learn more about what this programming language can do, look for LogoWriter Reference Guide published by Logo Computer Systems Inc.. An address is included on the reference page.

All the other software used in these lessons is published by Sunburst Communications, Inc.. There are only 10 disks for each program so it is best if you hand them out to pairs of computers. Sometimes the disk needs to be in drive A for menu choices and sometimes it does not. Pay close attention to this information on the Teacher information sheet. For information beyond what is furnished here, Sunburst provides a notebook of teacher information on each software package. If anyone would like to see these, ask Dave Fischer for them.

How to use the Math 2 Room 4 Computer Lab

Starting a program

1. Holding the disk at the top with thumb and index finger take it out of its envelope.
2. Put the disk in drive A with the label facing up.
See figure a.

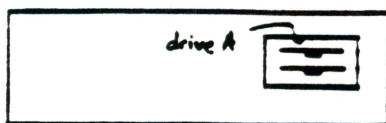


fig. a

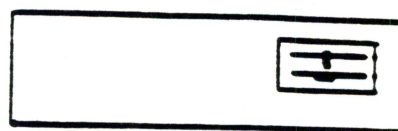
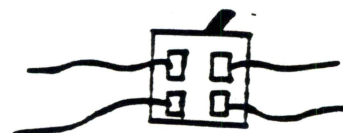


fig. b

3. Close the latch on drive A. See figure b.
4. Find the electrical outlet that the computer is hooked up to (figure c) and flip the switch to ON.

fig. c



NOTE: If the computer is on before the disk is in drive A press the reset button on the left front of the computer (figure d) after the disk is in place.

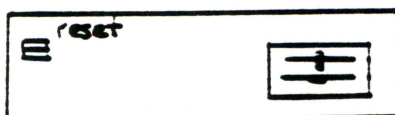


fig. d

5. A red light on the disk drive will come on. If it does not come on check to see that the power button on the right side of the computer is on (figure e).

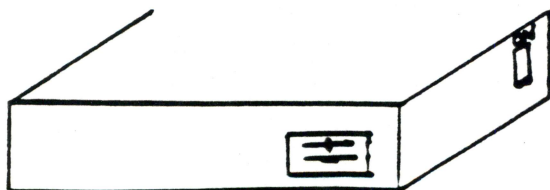
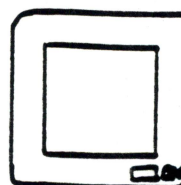


fig. e

6. If the monitor does not light up, check to see that it is turned on. The power switch is on the front of the monitor (figure f).

fig. f



Math 2 Room 4 Computer Lab continued.

If **LogoWriter** is being used, directions from the Teacher Information sheet need to be followed after turning the computer on.

If **Sunburst** software is being used, follow the directions on the screen until the "**Main Menu**" appears, then follow the directions on the lesson sheet.

Turning off the system

1. Turn off the system by turning the button at the electrical outlet off. All other buttons are left on.
2. Unlatch drive A, remove the disk and return it to its envelope.

How to use the Library Computer Lab

Starting a program

1. Holding the disk at the top with thumb and index finger take it out of its envelope.
2. Put the disk in drive A with the label facing up. (See figure a).

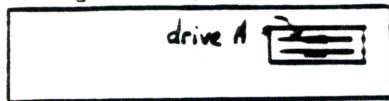


fig. a

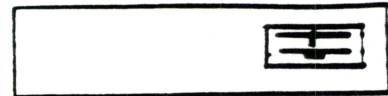


fig. b

3. Close the latch on drive A (figure b).
4. Press the three buttons marked Monitor, Auxiliary 1, and Auxiliary 2 (figure c).

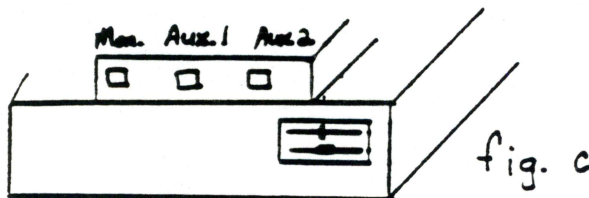


fig. c

NOTE: If the computer is on before the disk is in drive A press the reset button on the left front of the computer (figure d) after the disk is in place.

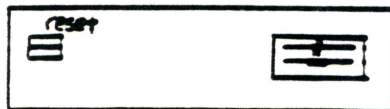


fig. d

5. A red light on the disk drive will come on. If it does not come on check to see that the power button on the right side of the computer is on (figure e).

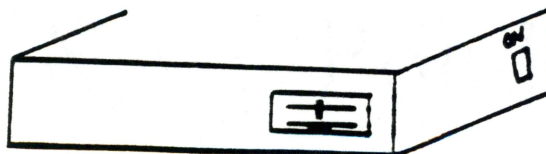
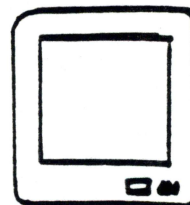


fig. e

6. If the monitor does not light up, check to see that it is turned on. The power button is on the front of the monitor (figure f).

fig. f



Library Computer Lab continued.

If **LogoWriter** is being used, follow the directions from the Teacher Information sheet before starting the lesson.

If **Sunburst** software is being used, follow the directions on the screen until the "**Main Menu**" appears, then follow the directions on the lesson sheet.

Turning off the system

1. Turn off the system by pressing the three buttons marked Monitor, Auxiliary 1, and Auxiliary 2.
2. Unlatch drive A, remove the disk and return it to its envelope.

Evaluation Form

Name (optional) _____
 Software _____
 Lesson _____
 Subject _____ Class size _____
 Which computer lab was used? _____
 Were all of the computers working? _____

<u>Teacher instructions</u>	Excellent	Good	Fair	Poor
1. Instructions are clear, concise, and understandable.	_____	_____	_____	_____
2. Objectives are accurate and complete.	_____	_____	_____	_____
3. Reading level is appropriate for intended learners.	_____	_____	_____	_____
4. Program information is clear and understandable.	_____	_____	_____	_____

Suggestions for teacher information sections. Use the back if necessary. _____

<u>Student lessons</u>	Excellent	Good	Fair	Poor
1. Instructions are clear, concise, and understandable.	_____	_____	_____	_____
2. Lesson motivates learner.	_____	_____	_____	_____
3. Lesson employs positive feedback and reinforcement.	_____	_____	_____	_____
4. Program handles learner input errors effectively.	_____	_____	_____	_____
5. Program helps students develop correct response.	_____	_____	_____	_____

Suggestions or comments for student lessons (continue on back). _____

Course Descriptions

Course Title	Course Length	Grade Level
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Math A	1 year	9, 10
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This is the first course in mathematics for non-college bound students. This course will introduce students to algebra, geometry and a variety of mathematical concepts. No student may enroll in Math A who has passed a semester of any higher level math class. Most students who successfully complete Math A should take Math B next. Some who demonstrate a thorough understanding of Math A (a B+ or better) may go on to take Algebra 1 next.

Math B	1 year	10, 11
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Prerequisite: Math A or equivalent.

This is the second course in mathematics for non-college bound students. The course will cover a variety of mathematical concepts including algebra, geometry, and probability and statistics. No student shall enroll in this course who has passed a semester of any higher level math class. Students who successfully complete Math B should go on to take Algebra 1.

Math C	1 year	12
--------	--------	----

Math C is a third year math class for non-college bound students who could not succeed in Algebra 1. The course exposes students to real world math situations such as calculated gross salary, net pay, income tax, buying a car, and making a budget. Use of computer software for mathematical applications is an important component of the course.

Algebra 1 1 year 9, 10, 11, 12

This is a course designed to provide students with the necessary thinking and reasoning skills to solve mathematical problems. Major concepts include solving equations, using formulas, signed numbers, graphing linear equations, and problem solving in essential applied areas.

Geometry 1 year 9, 10, 11, 12
Prerequisite: Algebra 1 with a C- or better.

This course will provide the student with a clear understanding of geometric concepts. It is designed to develop reasoning patterns and processes, to stimulate creative thinking, and to prepare the student for more advanced courses in mathematics.

Algebra 2 1 year 10, 11, 12
Prerequisite: Geometry with a C- or better.

Algebra 2 is a full year course that expands on the content of Algebra 1 and Geometry. The topics include linear and quadratic equations and their graphs, exponents, radicals, logarithms, systems of equations and complex numbers.

Software References

Logo Computer Systems Inc.
555 W. 57th St., Suite 1236
New York, NY 10019 (212) 265-5646

LogoWriter version 1.1 Disk Manager
(c) 1986 Logo Computer Systems Inc.
A site licensed educational product from LCSi.

Sunburst Communications, Inc.
101 Castleton Street
Pleasantville, NY 10570 (800) 338-3457

Building Perspective: Strategies in Problem Solving
For the IBM PC/PC jr.
(c) 1986 Sunburst Communications, Inc.

The Factory: Explorations in Problem Solving
For the IBM PC/PC jr.
(c) 1984 Sunburst Communications, Inc.

The Geometric Supposer: Triangles
For the IBM PC/PC jr.
(c) 1988 Sunburst Communications, Inc.

Green Globbs and Graphing Equations
For the IBM PC/PC jr.
(c) 1986 Sunburst Communications, Inc.

Interpreting Graphs
For the IBM PC/PC jr.
(c) 1986 Sunburst Communications, Inc.

The Royal Rules
For the IBM PC/PC jr.
(c) 1987 Sunburst Communications, Inc.

Logowriter

Teacher Information

Reading Level: 8th grade.

Objectives:

- To familiarize students with the keyboard of a computer.
- To develop understanding of complementary and supplementary (interior and exterior angles).
- To develop understanding of properties of regular polygons (congruent angles, congruent sides, sum of exterior angles is 360).
- To develop understanding of sequential ordering.

About the program:

Lesson 1 has students practice finding certain keys on a keyboard on the screen. It then shows the students some simple commands that will tell a turtle on the screen what to draw. Time is given for students to program the turtle with commands to draw a simple picture.

Lesson 2 has students review the commands learned so far and they practice by drawing two different size squares side by side. The lesson continues with commands being given to color in drawings. Students practice the commands by drawing and coloring a picture of their own.

Lessons 3 and 4 are used for practice. Students should recognize from these lessons that the turtle must turn the supplement of the interior measure given. For advanced students you may wish to remove the measurements on the figures and have students use their own numbers. It is important to check commands in case students need help. For example, students may use `rt 40 rt 40 rt 40` when they could use `rt 120`.

Lesson 5 introduces the repeat command. It is very important for students to follow LEARN 4. In this lesson students use all of the commands they have learned for the turtle. It may be tricky for students to draw one shape inside of another, they will use `PU` and `PD`. Remind students that they should try to draw all four figures on the screen at once and color them before moving on to the next problem.

Lessons 6 gives students practice using all of the turtle commands. If some students need more time on a previous lesson this may be used for students ready to do more.

NOTE: There is a way to have students save their work on disk. This would allow students to move through a lesson without showing you the drawing or writing down the commands. If you would like to do this you must obtain enough disks for your classes then follow the directions on the Logo disk to 1) format the disks and install 5) Scrapbook without LogoWriter. Be sure to alter the lesson handouts accordingly.

Booting up:

To start the program put the disk in drive A and turn the computer on. If the computer is already on, press reset.

```
-----  
                        TM  
LOGOWRITER  
version 1.1  
DISK MANAGER  
-----
```

The first set of directions will direct you to press ENTER (↵).

(c) copyright Logo Computer Systems Inc.

Press ENTER

```
-----  
LOGOWRITER  
version 1.1  
DISK MANAGER  
-----
```

1) Format a disk

Install on a formatted disk:

- 2) LogoWriter and Tutorials
- 3) LogoWriter and Tools
- 4) LogoWriter only
- 5) Scrapbook without LogoWriter

Or:

- 6) Copy a disk
- 7) Specify a printer
- 8) Exit to DOS

Type the number you want:
Press FN-10 for Help

The next set of directions (menu) will be numbered 1-8.

Press 8.

A>
A>

After A> appears
type logo and press
ENTER (↵).

Press ENTER again.

CONTENTS

LEARN 1
LEARN 2
LEARN 3
LEARN 4
NEWPAGE

...

...

...

The screen should
now have the
heading "CONTENTS".

This is the menu
the students will
be working with.

IMPORTANT: The disk must remain in drive A during the
entire lesson.


LOGOWRITER LW 1

Name(s): _____

Objective: To learn simple commands that allow you to make a drawing on the computer screen.

DIRECTIONS (Read carefully):

What you see on the screen before you is called a menu. After an item is selected on the menu a set of directions will appear, similar to that of a recipe. Read the directions and press the key(s) as described on the screen.

1. Using the arrow keys move the flashing symbol (cursor) to LEARN 1. Press the key with the symbol  (also known as ENTER). Follow the directions given on the screen for this process. When you are finished, press ESC.
2. From the "CONTENTS" page, move the cursor to LEARN 2 and press ENTER. Follow the directions given. When you have gone through this lesson once and the directions on the screen read "Do some turtle drawing on your own", answer the following question. Do not press ESC at this time.

What do the following abbreviations stand for?

- | | |
|-------------|-------------|
| a) rt _____ | e) pu _____ |
| b) lt _____ | f) pd _____ |
| c) fd _____ | g) cg _____ |
| d) bk _____ | |

After you have answered these questions type ct. What happened? _____.

What do you think ct stands for? _____.

Now you and your partner are to draw a simple picture. Discuss what you might draw. You can try anything. Type the command, then press ENTER. Continue your drawing in this manner. Refer to the answers you provided to the previous question if you need help.

As the commands are being entered they should be written on the back of this paper. If you are working with someone, one should type, the other write.

When you are finished with your picture, draw it on the back of this paper. Check the time. The more time there is remaining in the class period, the more complicated the picture can be.

DRAWING

COMMANDS

LOGOWRITER LW 2

Name(s): _____

Objective: To practice drawing with the turtle and to learn how to color a drawing.

What do these abbreviations stand for?

- | | |
|-------------|-------------|
| a) rt _____ | e) pu _____ |
| b) lt _____ | f) pd _____ |
| c) fd _____ | g) cg _____ |
| d) bk _____ | h) ct _____ |

If you don't remember these commands select LEARN 2 from the "CONTENTS" page for review.

1. From the "CONTENTS" move the cursor to NEWPAGE and press ENTER. Draw two different size squares side by side. Remember the special properties (angles, sides) of a square. In the space below sketch your drawing and write the commands used.

COMMANDSDRAWING

Hint: Use pu to move to draw the second square and pd before drawing it.

When you have completed the drawing of the squares, return to the "CONTENTS" page. Which key do you press to return to the "CONTENTS" page? _____.

(Continued on back)

2. Select LEARN 3 and press ENTER. Follow the directions on the screen. When a command appears at the bottom of the screen, press ENTER.

What color is:

SETC 1 _____, SETC 2 _____, SETC 3 _____ ?

At the end of LEARN 3. clear the screen (Don't do LEARN 4). With your partner, draw and color your own picture. The amount of time left in class will determine how complicated your picture will be. Be sure to copy the picture and the commands below.

DRAWING

COMMANDS

LOGOWRITER LW 3

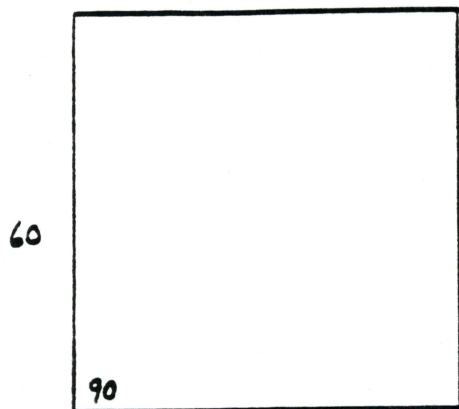
Name(s): _____

Objective: To practice use of turtle commands for drawing.

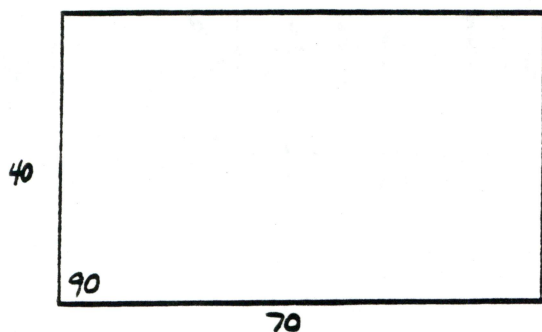
Select NEWPAGE from "CONTENTS".

Draw as many of the following as possible in any order you would like. Write the commands next to each picture. Show each picture to your teacher before starting the next one.

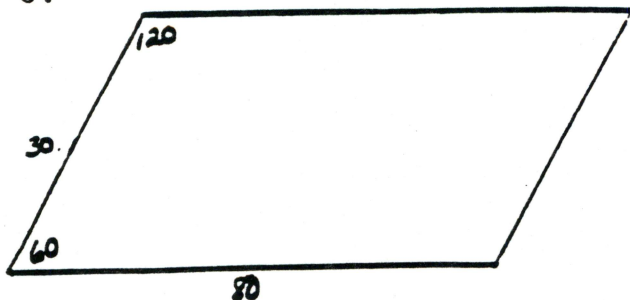
1.



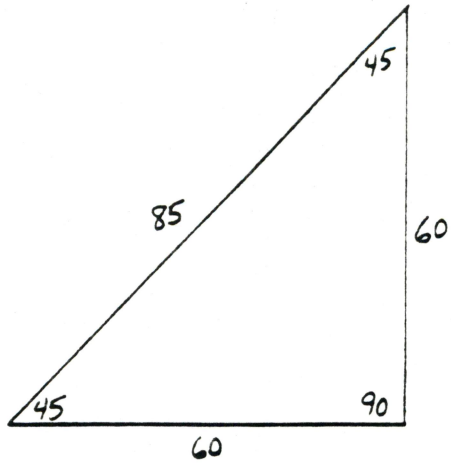
2.



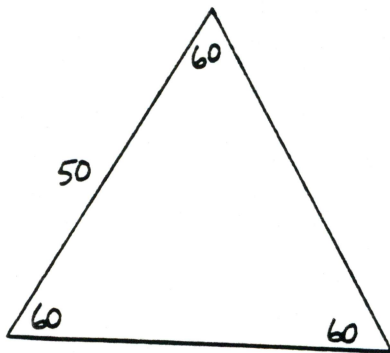
3.



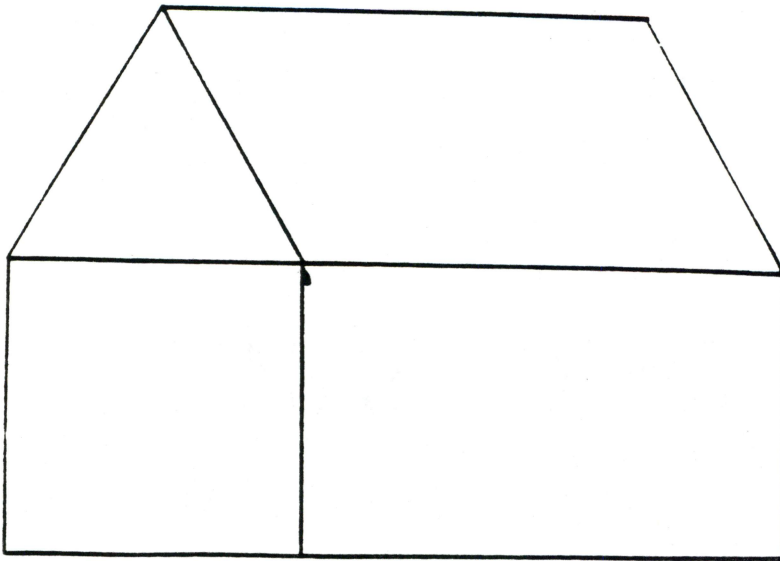
4.



5.



6.



EXTRA CREDIT: Can you draw a door in the house? a window?

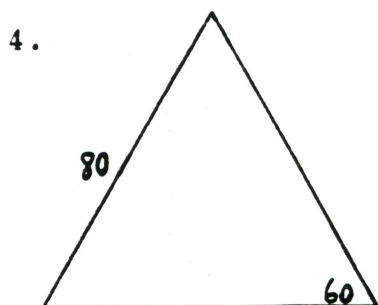
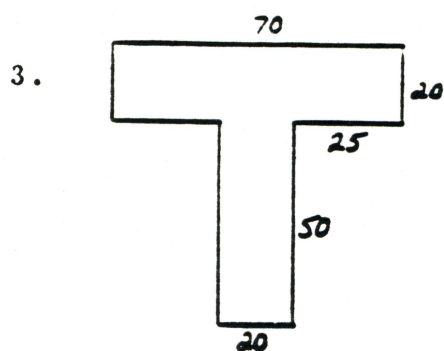
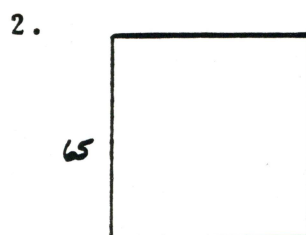
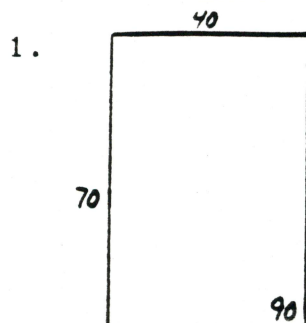
LOGOWRITER LW 4

Name(s): _____

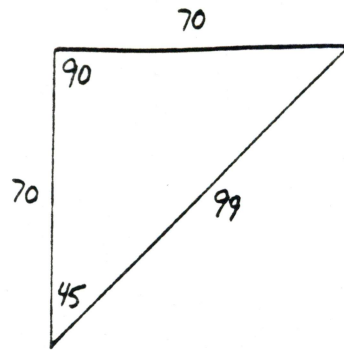
Objective: To practice use of turtle commands for drawing.

Select NEWPAGE.

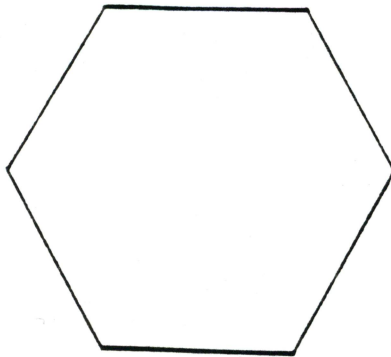
Draw each of the following shapes on the screen. Write the commands next to each picture. Show each picture to your teacher before starting the next picture.



5.



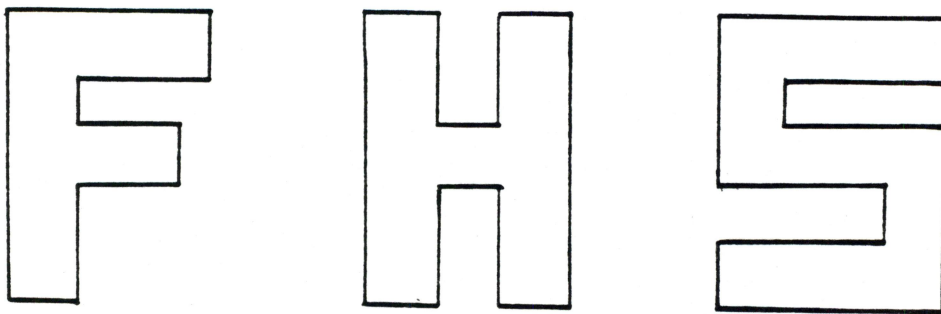
6.



Each side length is 80 units.
Each interior angle measures 120°.

7. Clear the screen. Type: Repeat 6 [fd 50 rt 60]
Draw what appears on the screen.

8.



You do not need to write the commands down for this drawing.
Instead label the drawing with the numbers you use for each segment.

LOGOWRITER LW 5

Name(s): _____

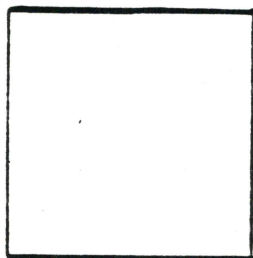
Objective: To learn use of the repeat command to save steps.

Select and follow LEARN 4. When finished with LEARN 4 return to "CONTENTS" and select NEWPAGE.

NEWPAGE directions:

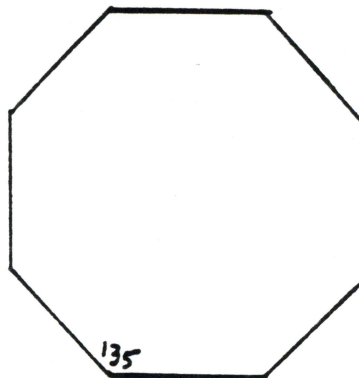
You will use the repeat command to draw the following six shapes. Credit will be given only for correct repeat commands. Write the command next to each Repeat on this paper. **When the four shapes on the bottom of this page are on the screen, show your teacher.**

On the left side of the screen draw a square.



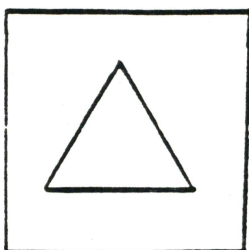
Repeat _____

On the right side of the screen draw a regular octagon.



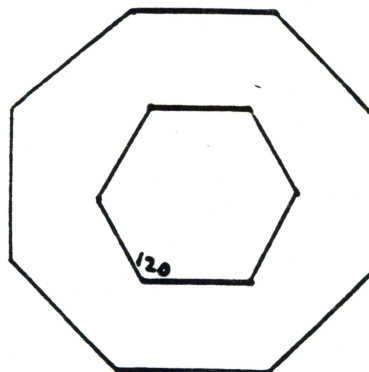
Repeat _____

Inside the square, draw an equilateral triangle.



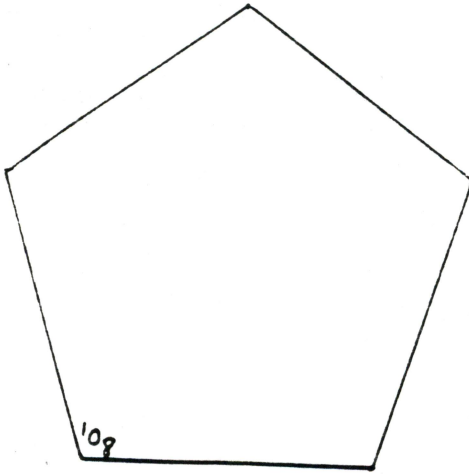
Fill in the triangle with any color.
Remember PU before moving the turtle inside and pd before coloring.

Inside the octagon, draw a regular hexagon.



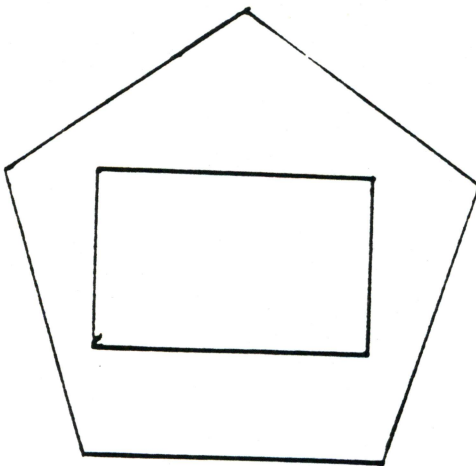
Fill in the hexagon with a different color.

Clear graphics. As large as you can,
draw a regular pentagon.



Repeat _____

Inside the pentagon, draw a rectangle.



Repeat _____

Fill in the rectangle with any color.
Remember PU and PD.
Show your teacher when finished.

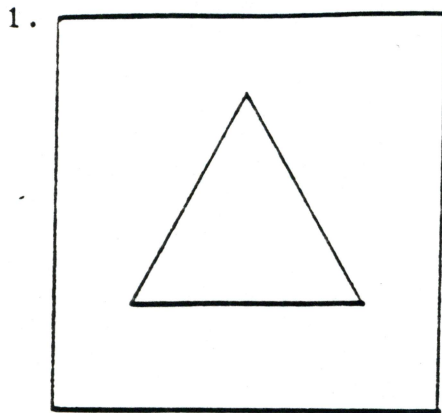
LOGOWRITER LW 6

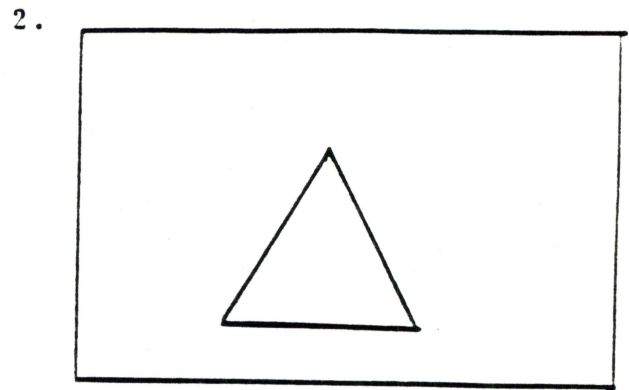
Name(s): _____

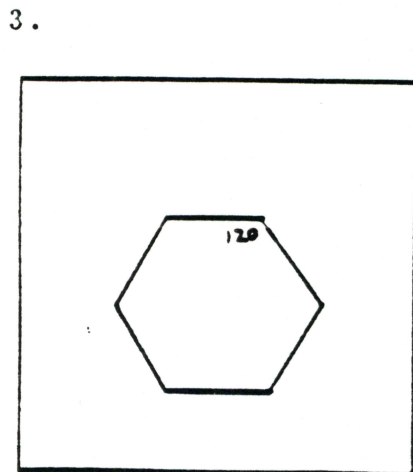
Objective: To practice using repeat commands.

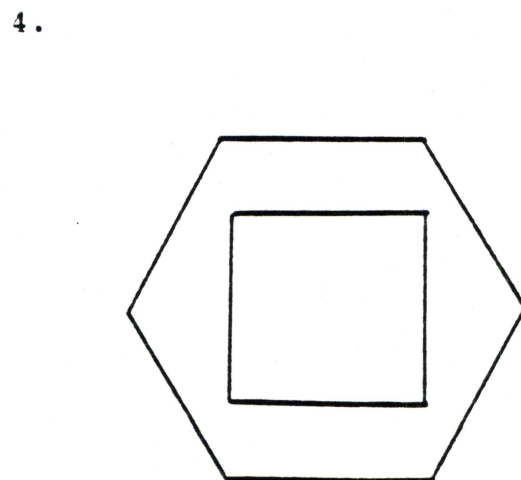
Select NEWPAGE.

Use Repeat commands to draw the figures. Write the commands in the space provided.



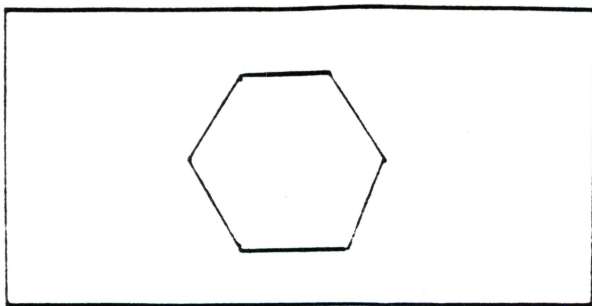




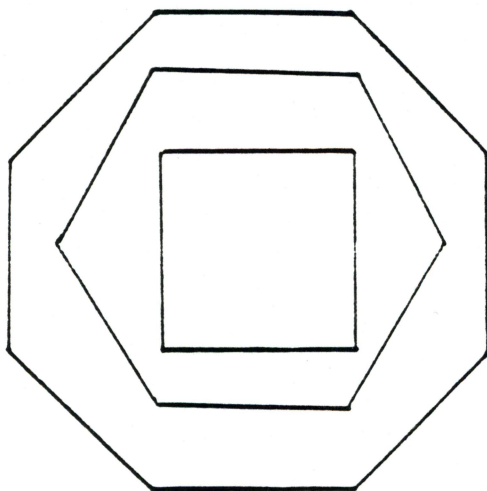


NOTE: All of the figures except the rectangle are equilateral and equiangular.

5.



EXTRA CREDIT:



BUILDING PERSPECTIVE**Teacher Information**

Reading Level: 6th grade.

Objectives:

- To develop reasoning skills through hypothesis testing.
- To develop and coordinate spatial perceptions.

About the program:

In Lesson 1 it is very important for students to read carefully as they go through the "instructions". The "instructions" explain how to view the buildings from different sides and how to make predictions. It is also important for students to record on their paper the colors of the different sizes of the buildings. The students will predict the sizes of the buildings based on the information they have seen. They will check their prediction and make corrections in their predictions if necessary. This lesson uses only 3x3 arrays of buildings.

Lessons 2 and 3 are similar to Lesson 1 with the exception of not going through the "information" selection from the menu. These two lessons use 3x3, 4x4, and 5x5 arrays.

Note: The disk does not need to remain in the drive to make selections from the main menu.

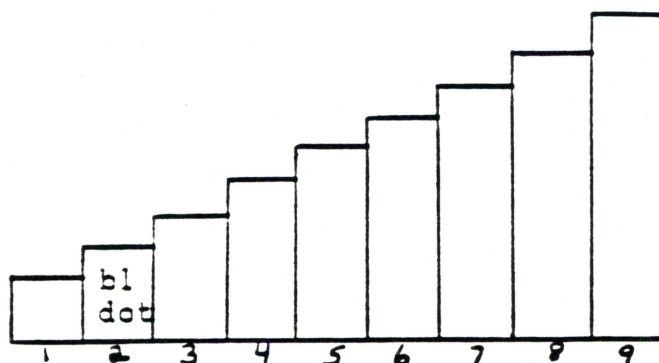
BUILDING PERSPECTIVE
BP 1

Name(s): _____

Objective: To predict the size of the buildings by looking at them from various sides.

Select "instructions" from menu. Follow the directions on the screen. From information given in the "instructions" fill in the colors of the buildings below.

For example.
building 2
has blue
dots.



When finished with "instructions", select "play the game". You are to guess the size of each building by looking at them from different sides. Write down the numbers of the buildings in the boxes marked practice. When you think you know the size of each building write the numbers in the prediction box. Check your prediction. If your prediction was wrong try again.

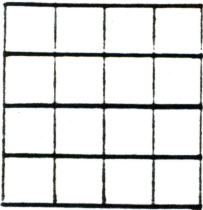
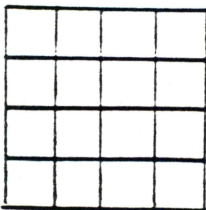
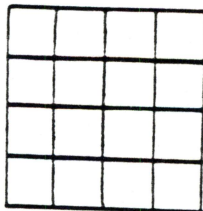
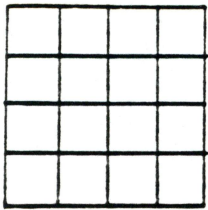
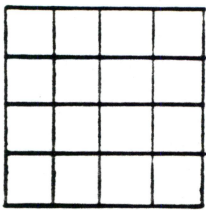
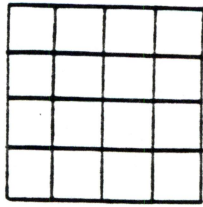
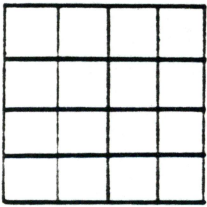
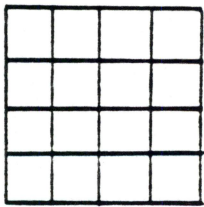
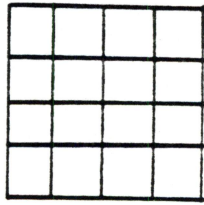
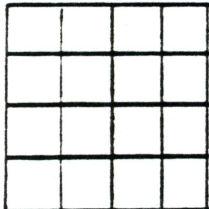
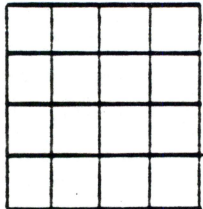
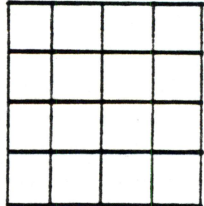
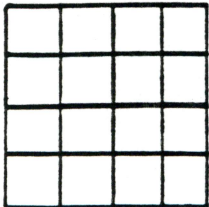
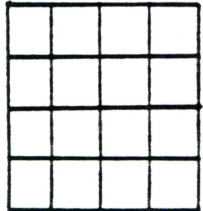
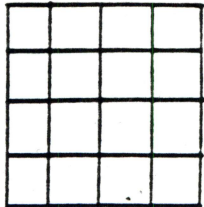
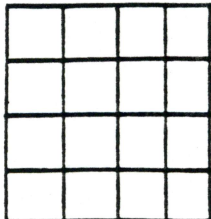
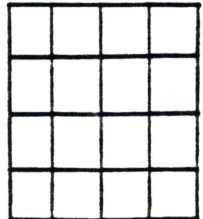
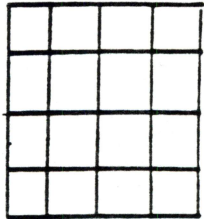
3x3 array

	practice	prediction	correct?	prediction
1.	<div style="border: 1px solid black; width: 60px; height: 60px; display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; width: 100%; height: 100%;"></div> </div>	<div style="border: 1px solid black; width: 60px; height: 60px; display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; width: 100%; height: 100%;"></div> </div>	yes/no	<div style="border: 1px solid black; width: 60px; height: 60px; display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; width: 100%; height: 100%;"></div> </div>
2.	<div style="border: 1px solid black; width: 60px; height: 60px; display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; width: 100%; height: 100%;"></div> </div>	<div style="border: 1px solid black; width: 60px; height: 60px; display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; width: 100%; height: 100%;"></div> </div>	yes/no	<div style="border: 1px solid black; width: 60px; height: 60px; display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; width: 100%; height: 100%;"></div> </div>
3.	<div style="border: 1px solid black; width: 60px; height: 60px; display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; width: 100%; height: 100%;"></div> </div>	<div style="border: 1px solid black; width: 60px; height: 60px; display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; width: 100%; height: 100%;"></div> </div>	yes/no	<div style="border: 1px solid black; width: 60px; height: 60px; display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; width: 100%; height: 100%;"></div> </div>

Play the game for 3x3 arrays until you have predicted the buildings correctly three times. See the back for further directions.

Select "change array size". Change to 4x4. Play the game as many times as the remaining time allows.

4x4 array

	practice	prediction	correct	prediction
1.			yes/no	
2.			yes/no	
3.			yes/no	
4.			yes/no	
5.			yes/no	
6.				

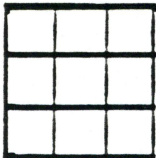
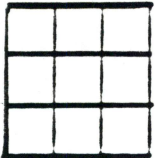
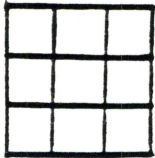
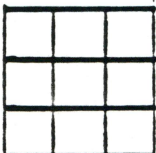
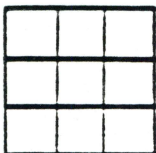
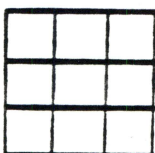
BUILDING PERSPECTIVE
BP 2

Name(s): _____

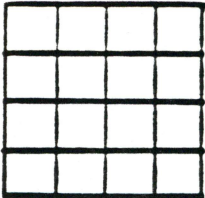
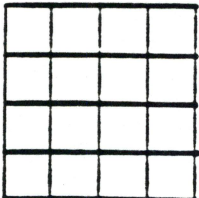
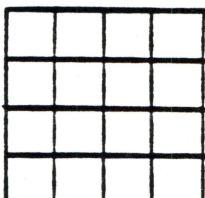
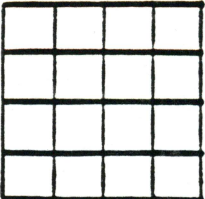
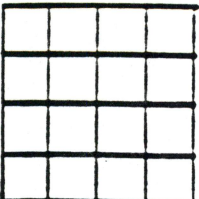
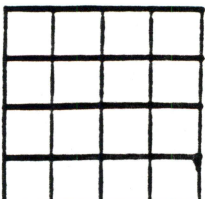
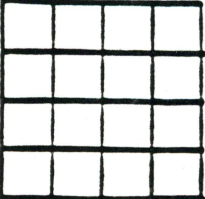
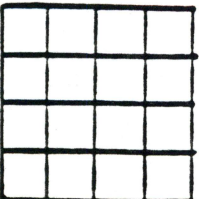
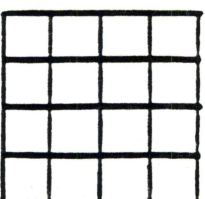
Objective: To predict building sizes with more buildings involved.

1. "Play game" for 3x3 two times.
2. Select "change array size" and change to 4x4. Play three times.
3. Change array size to 5x5 and play for remaining time.

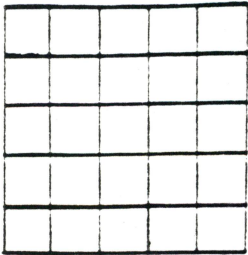
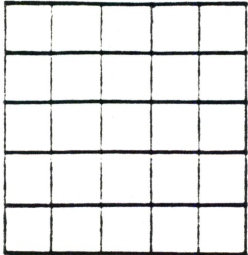
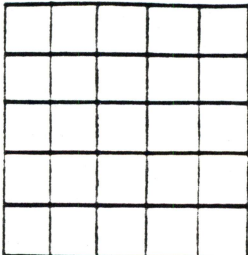
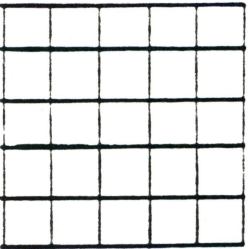
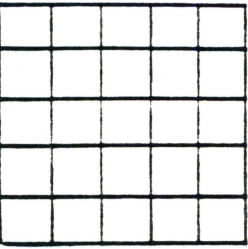
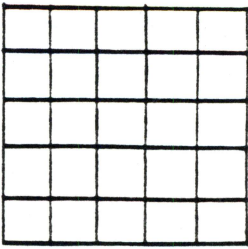
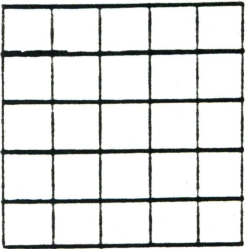
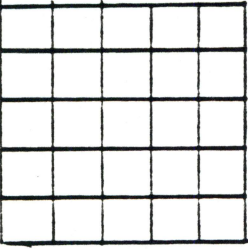
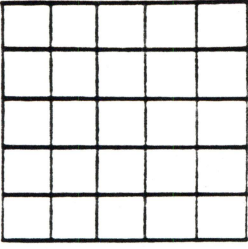
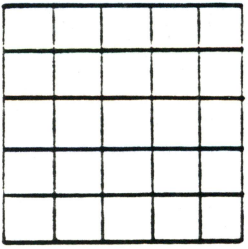
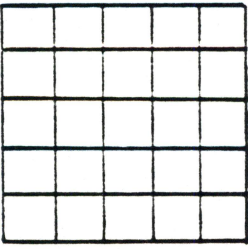
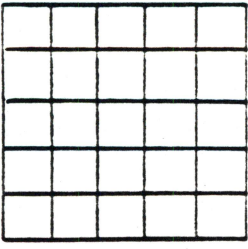
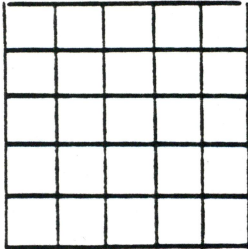
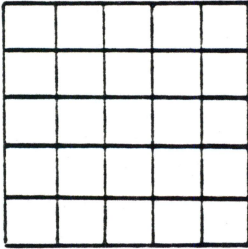
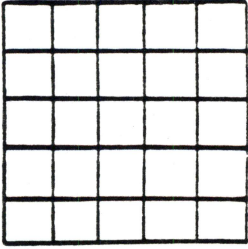
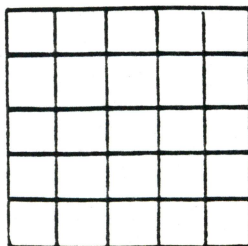
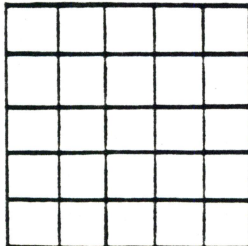
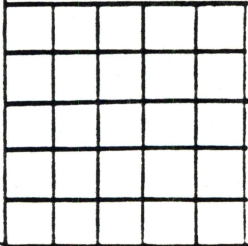
3x3 array

	practice	prediction	correct?	prediction
1.				
2.				

4x4 array

	practice	prediction	correct?	prediction
1.				
2.				
3.				

5x5 arrays

	practice	prediction	correct?	prediction
1.				
2.				
3.				
4.				
5.				
6.				

THE ROYAL RULES

Teacher Information

Reading Level: 9th grade.

Objective:

To develop recognition of number patterns and rules.

About this program:

Lessons 1-4 progress through the four levels of play on this program. Lesson 4 is the most difficult and should be avoided except for the exceptional student.

The disk needs to be in drive A until after the start of each level. It also needs to be in after three successful plays of a level. NOTE: You may wish to assign a disk to two or three computers and have the students be responsible for sharing the disks when they need to.

Descriptions of each level:

THE CITY

The rules that describe the three numbers are simple and straight-forward.

Examples: "all numbers are even,"
 "all numbers are multiples of 5,"
 "all numbers end in 25."

THE DUCHY

The third number is a result of operations applied to the first two numbers.

Examples: "twice the first number plus three times the second equals the third number,"
 "the third number is equal to the sum of the squares of the first two numbers."

THE PROVINCE

The rules are similar to THE CITY except they are tricky.

Example: For the numbers 100, 200, 300 the rule is "multiples of 10", not "increase of 100".

Checking rules is very important here.

THE KINGDOM

The rules here are very tricky. The rule may only apply to one of the numbers.

Example: For the numbers 2, 10, 19 and 13, 15, 17
the rule is "the third number is odd."

ROYAL RULES
RR 1

Name(s): _____

Objective: Guess the patterns for the three numbers.

1. Select "The City" from the main menu.
2. Select "Sunburst Rules". (Always play using Sunburst Rules.)

At this level, the rules you will be trying to determine are simple and straight forward.

EXAMPLES:

For the numbers , the rule is

13, 97, 65	"All numbers are odd."
75, 5, 110	"All numbers are divisible by 5."
124, 924, 224	"All numbers end in 24."

Example of game:

Your challenge

These numbers fit the rule:

60 140 140

1. Enter three numbers under 1st, 2nd, and 3rd that you think will fit the rule.

1st	2nd	3rd	Yes/No
10	20	30	No
20	60	60	Yes
30	60	60	No
40	160	60	Yes
120	100	40	Yes
80	80	80	Yes

2. After three consecutive "Yes" answers, write the rule.

Rule: Each number is a multiple of 20.

3. Take the quiz to check your rule.

For each game you play:

1. Try different sets of numbers until you get three "Yes" answers. Press H to see other numbers that fit the rule.
2. Write down the rule for the set of three numbers. Use a complete sentence.
3. Press Q for quiz. From the quiz, copy two sets of numbers that do fit the rule.
4. Play enough games so you have six different rules.

Games

1. Rule: _____

From the quiz, two sets of numbers that fit the rule.

a) _____, _____, _____

b) _____, _____, _____

2. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

3. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

NOTE: After winning three Magic Books, be sure there is a disk in the drive, then select "Return to the menu". (If there is not a disk get one from your teacher or your neighbor.) Select "The City" and "Sunburst Rules".

4. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

5. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

6. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

ROYAL RULES
RR 2

Name(s): _____

Objective: To guess the patterns of the three numbers.

1. Select "The Duchy" from the main menu.
2. Select "Sunburst Rules" (Always play using Sunburst Rules.)

At this level you will find the rule that was applied to the first two numbers so that the result was the third number. Calculators may come in handy for this level.

EXAMPLES:

For the numbers	the rule is
-----	-----
10, 17, 27	"The third number is the sum of the first and second numbers."
8, 20, 160	"The third number is the product of the first two numbers."

For each game you play:

1. Try different sets of numbers until you get three consecutive "Yes" answers. Press H to see other numbers that fit the rule.
2. Write down the rule for the set of three numbers. Use a complete sentence.
3. Press Q for quiz. For the quiz you will be required to find the third number. From the quiz, copy two sets of numbers that do fit the rule.
4. Play enough games so you have six different rules.

Games

1. Rule: _____

From the quiz, two sets of numbers that fit the rule.

a) _____, _____, _____

b) _____, _____, _____

2. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

3. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

NOTE: After winning three Royal Crests, be sure there is a disk in the drive, then select "Return to the menu". (If there is not a disk there get one from your teacher or neighbor.) Select "The Duchy" and Sunburst Rules". Find another three rules.

4. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

5. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

6. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

After finding six different rules you may play more of "The Duchy" or switch to "The City". Again be sure there is a disk in the drive before trying to get to the menu.

Rule: _____

Rule: _____

Rule: _____

Rule: _____

Rule: _____

ROYAL RULES
RR 3

Name(s): _____

Objective: To find the number pattern.

1. Select "The Province" from the main menu.
2. Select "Sunburst Rules". (Always play using Sunburst Rules.)

At this level the rules are similar to those of "The City" but a little trickier.

EXAMPLES:

For the numbers	the rule is
-----	-----
20, 50, 10	"The numbers are multiples of 5."
49, 7, 35	"The numbers are all odd."

You might have thought the first example had the rule "The numbers are multiples of 10" or the second example had the rule "The numbers are multiples of 7". Both of these rules fit the numbers but they are not the rules intended.

For each game you play:

1. Try different sets of numbers until you get three consecutive "Yes" answers. Press H to see other numbers that fit the rule.
2. Write down the rule for the set of three numbers. Use a complete sentence.
3. Press Q for quiz. From the quiz, copy two sets of numbers that do fit the rule.
4. Play enough games so you have six different rules.

Games

1. Rule: _____

From the quiz, two sets of numbers that fit the rule.

a) _____, _____, _____

b) _____, _____, _____

2. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

3. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

NOTE: After winning three Goblets, be sure there is a disk in the drive, then select "Return to the menu". (If there is not a disk get one from your teacher or your neighbor.) Select "The Province" and "Sunburst Rules". Find another three rules.

4. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

5. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

6. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

After finding six rules you may continue playing "The Province" or select "The City" or "The Duchy". Be sure there is a disk in the drive before going back to the menu.

Rule: _____

Rule: _____

Rule: _____

Rule: _____

Rule: _____

ROYAL RULES
RR 4

Name(s): _____

Objective: To find the number pattern.

1. Select "The Kingdom" from the main menu.
2. Select "Sunburst Rules". (Always use Sunburst Rules.)

At this level the rules are very tricky. They may apply to only one of the numbers.

EXAMPLES:

For the numbers	the rule is
-----	-----
12, 21, 33	"The first number is even."
15, 45, 25	"The third number is a perfect square."

For each game you play:

1. Try different sets of numbers until you get three consecutive "Yes" answers. Press H to see other numbers that fit the rule.
2. Write down the rule for the set of three numbers. Use a complete sentence.
3. Press Q for quiz. From the quiz, copy two sets of numbers that do fit the rule.
4. Play enough games so you have six different rules.

Games

1. Rule: _____

From the quiz, two sets of numbers that fit the rule.

a) _____, _____, _____

b) _____, _____, _____

2. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

3. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

NOTE: After winning three Crowns, be sure there is a disk in the drive, then select "Return to the menu". (If there is not a disk get one from your teacher or your neighbor.) Select "The Kingdom" and "Sunburst Rules". Find another three rules.

4. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

5. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

6. Rule: _____

a) _____, _____, _____

b) _____, _____, _____

After finding six rules you may play any of the selections (The City, The Duchy, The Province, or The Kingdom). Just be sure there is a disk in the drive before going to the main menu.

Rule: _____

Rule: _____

Rule: _____

Rule: _____

Rule: _____

Rule: _____

Rule: _____

**GREEN GLOBS AND
GRAPHING EQUATIONS****Teacher Information**

Reading Level: 7th grade.

Objectives:

To develop recognition of the graphs for equations of lines, circles, and parabolas.

To allow practice for writing equations of lines, circles, and parabolas.

About the Program:

Lesson 1 uses the main menu selection #1 Equation Plotter. The students enter various linear equations in the computer and the graphs appear on the screen. Students are asked questions about similarities and differences among the graphs. Students need to know what the x-axis and y-axis are but y-intercept and slope are not part of this lesson.

Lessons 1, 2, and 3 are meant to be drawn on a square 8x8 grid. Directions are included in each lesson if the size of the grid needs to be changed.

Lesson 2 uses Equation Plotter to graph parabolas. The definition of vertex is given and students are asked to identify the vertex of each graph. Again similarities and differences are the center of focus in this lesson.

Lesson 3 also uses Equation Plotter and students see the graphs of circles. Students will identify the center and radius of each circle that is graphed. Questions are asked to direct students to the relation between the center and radius with the equation.

Lesson 4 uses the main menu selection #3 Green Globes. This game urges students to come up with equations that will "hit" the most green globes at one time. There are thirteen globes on the coordinate plane and the less equations it takes to hit all of them the higher the score.

NOTE FOR GREEN GLOBS: At times the directions on the screen will tell the students to save their score (highest score for that disk). This can only be done if a disk is present in drive A. Directions on the student worksheet say to ask the teacher to save a score of over 40. This will ensure that a disk is present. If there are already too many scores of over 40, a higher minimum score will need to be made.

NOTE: The disk must remain in drive A if a different selection is to be made from the main menu.

GREEN GLOBS AND GRAPHING EQUATIONS

Name(s): _____

Lesson 1 - Graphing Lines

Objective: To recognize graphs of linear equations.

Directions:

1. From the main menu select "Equation Plotter".
2. Press 2 for "Square grid" and ENTER.

The boundaries should be: x from -8 to 8
 y from -8 to 8.

If the boundaries need to be changed, follow the directions on the screen. Press ENTER when the boundaries are correct.

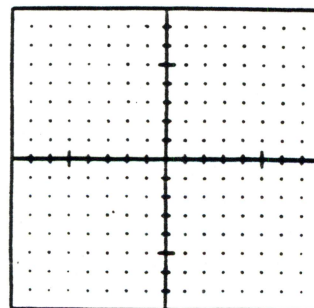
Type each set of equations so they are graphed on the same set of axes. Sketch the graphs on the axes at the right and label as a, b, c, and so on.

Watch for similarities and differences in each set of graphs.

1. a) $x = 6$
 b) $x = -3$
 c) $x = 2.4$

1.

Describe these lines:

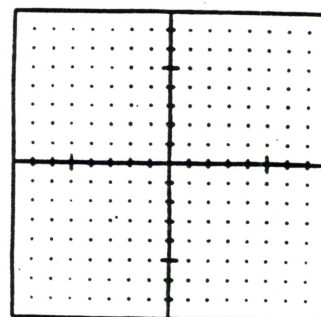


Clear the axes by pressing ESC. then press ENTER.

2. a) $y = -3$
 b) $y = 5$
 c) $y = 2.4$

2.

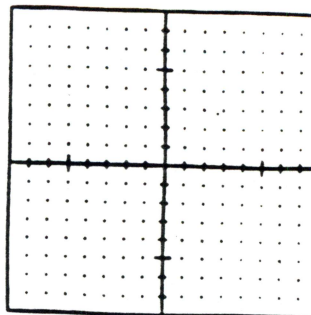
Describe these lines:



Clear the axes.

3. a) $y = x$
 b) $y = x + 2$
 c) $y = x + 5$
 d) $y = x - 1$
 e) $y = x - 3$

3.



Describe what is similar
 about all of these lines.

At what point does each line cross the y axis?

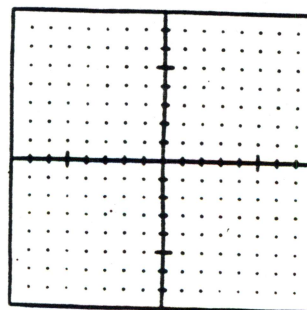
a) _____ b) _____ c) _____ d) _____ e) _____

Describe how the graph changes when a number is added to
 $y = x$. _____

Clear the axes.

4. a) $y = x$
 b) $y = 3x$
 c) $y = 6x$

4.



Describe what happens to the graph when x is multiplied by
 a positive integer.

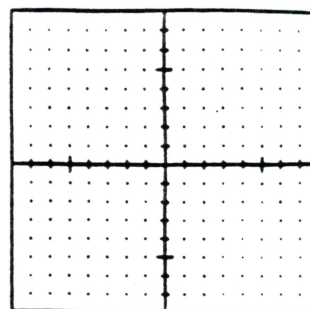
- d) $y = -x$
 e) $y = -2x$
 f) $y = -5x$

Describe what happens to the graph when x is multiplied by
 a negative integer.

Clear the axes.

5. a) $y = 1/2x$
 b) $y = 1/5x$
 c) $y = -1/4x$
 d) $y = -1/3x$

5.



Describe what happens to the graph when x is multiplied by a number:

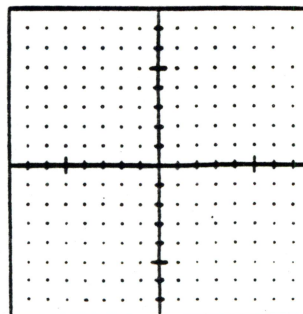
between 0 and 1 _____,

between -1 and 0 _____.

Clear the axes.

6. a) $y = 3x$
 b) $y = 3x + 2$
 c) $y = 3x + 5$
 d) $y = 3x - 6$
 e) $y = -3x$
 f) $y = -3x + 4$
 g) $y = -3x - 3$

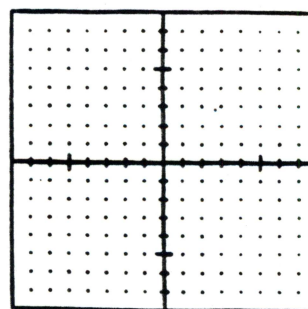
6.



Clear the axes.

7. a) $y = .5x$
 b) $y = .5x + 3$
 c) $y = .5x - 5$
 d) $y = -.5x$
 e) $y = -.5x + 2$
 f) $y = -.5x - 1$

7.



GREEN GLOBS AND GRAPHING EQUATIONS

Name(s): _____

Lesson 2 - Graphing Parabolas

Objective: To develop recognition of equations of parabolas.

Directions:

1. From the main menu select "Equation Plotter".
2. Press 2 for "Square grid" and ENTER.

The boundaries should be: x from -8 to 8
 y from -8 to 8.

If the boundaries need to be changed. follow the directions on the screen. Press ENTER when the boundaries are correct.

Type each set of equations so they are graphed on the same set of axes. Sketch the graphs on the axes at the right and label as a, b, c, and so on.

Watch for similarities and differences in each set of graphs.

Press ↑ for exponent and then type 2.

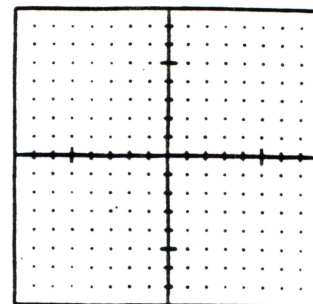
Definition of vertex: The turning point of the curve.

1. a) $y = x^2$
- b) $y = (x + 1)^2$
- c) $y = (x + 3)^2$
- d) $y = (x - 2)^2$
- e) $y = (x - 5)^2$

vertex

(0,0)
(-1,0)

1.

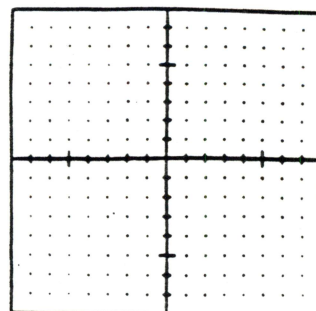


Describe in detail how the graph changes after you enter each equation:

vertex

2.

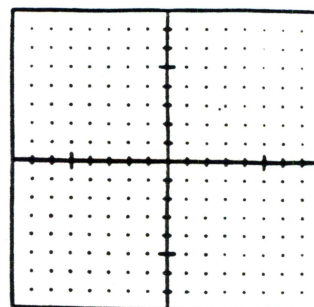
2. a) $y = x^2$
 b) $y = x^2 - 1$
 c) $y = x^2 - 4$
 d) $y = x^2 + 3$
 e) $y = x^2 + 6$



Describe in detail how the graph changes after you enter each equation:

3. a) $y = x^2$
 b) $y = 2x^2$
 c) $y = 5x^2$
 d) $y = 1/2x^2$
 e) $y = -1/5x^2$

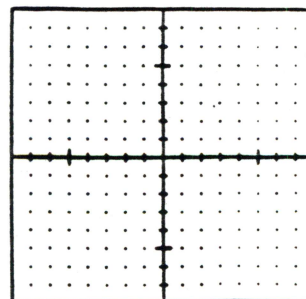
3.



How do the graphs change when x is multiplied by a positive number?

4. a) $y = x^2$
 b) $y = -x^2$
 c) $y = -(x + 3)^2$
 d) $y = -1/5x^2$

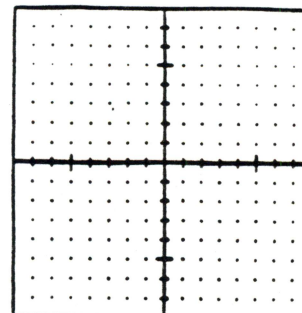
4.



How do the graphs change when x is multiplied by a negative number?

5. a) $x = y^2$
 b) $x = (y - 3)^2$
 c) $x = 4y^2$
 d) $x = 1/2y^2 + 4$
 e) $x = 3y^2$

5.



Describe how these graphs differ from those in # 1 - 4.

GREEN GLOBS AND GRAPHING EQUATIONS

Name(s): _____

Lesson 3 - Graphing Circles

Objective: To develop recognition of circle equations.

Directions:

1. From the main menu select "Equation Plotter".
2. Press 2 for "Square grid" and ENTER.

The boundaries should be: x from -8 to 8
 y from -8 to 8.

If the boundaries need to be changed, follow the direction on the screen. Press ENTER when the boundaries are correct.

Type each set of equations so they are graphed on the same set of axes. Sketch the graphs on the axes at the right and label as a, b, c, and so on.

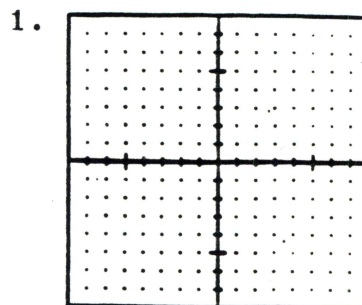
Watch for similarities and differences in each set of graphs.

Press ↑ for exponent and then type 2.

Definition of radius: The length of a segment from the center to a point on the circle.

1. a) $x^2 + y^2 = 4$
- b) $x^2 + y^2 = 9$
- c) $x^2 + y^2 = 16$
- d) $x^2 + y^2 = 25$

radius



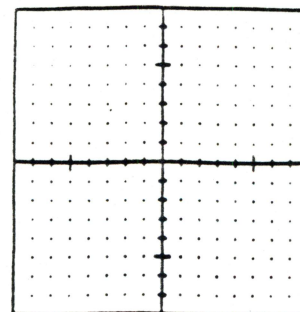
What part of the equation determines the radius?

What is the center of each of these circles?

Coordinates
of center

2. a) $x^2 + (y + 4)^2 = 25$
 b) $x^2 + (y + 1)^2 = 25$
 c) $x^2 + (y - 1)^2 = 25$
 d) $x^2 + (y - 5)^2 = 25$

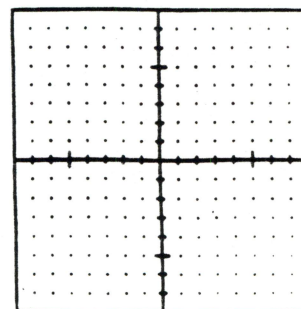
2.



Coordinates
of center

3. a) $(x + 1)^2 + y^2 = 16$
 b) $(x + 3)^2 + y^2 = 16$
 c) $(x - 4)^2 + y^2 = 16$
 d) $(x - 6)^2 + y^2 = 16$

3.

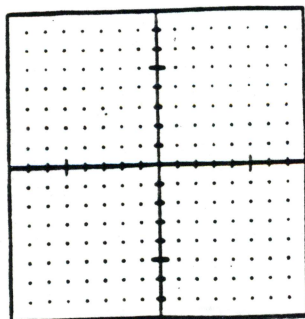


Center

Radius

4. a) $(x + 1)^2 + (y - 2)^2 = 16$
 b) $(x - 3)^2 + (y - 4)^2 = 25$
 c) $(x + 4)^2 + (y + 5)^2 = 36$
 d) $(x - 2)^2 + (y + 3)^2 = 9$

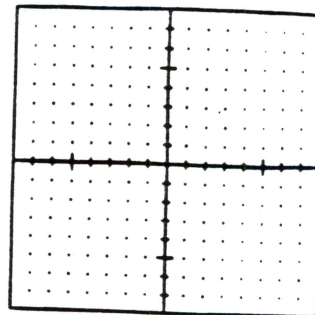
4.



Check each of your equations on the equation plotter and sketch the graphs:

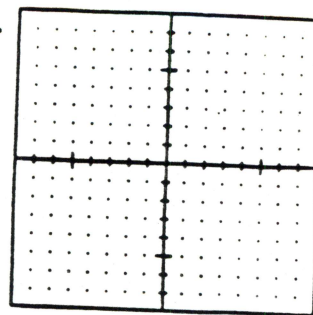
5. Write an equation of a circle with center on the x-axis and a radius of 3.

5.



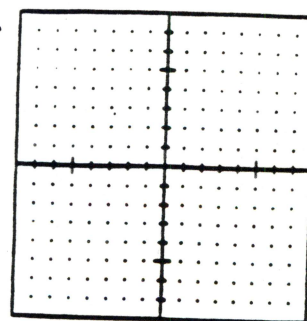
6. Write an equation of a circle with center on the y-axis and a radius of 5.

6.



7. Write the equation of a circle with center at (0,0) and a radius of 4.

7.



8. Write the equation of a circle with radius 3 and the center is in:

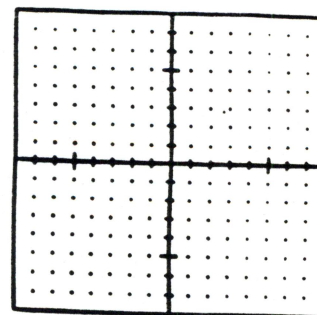
- a) quadrant 1

- b) quadrant 2

- c) quadrant 3

- d) quadrant 4

8.



GREEN GLOBS

Name(s): _____

Lesson 4

Objective: To practice writing equations of lines, circles and parabolas.

Select "Green Globes" from the main menu.

There are some green globs on a graph. You shoot at the globs by writing equations for the computer to graph.

The object of this game is to hit as many green globs as possible with each shot.

The game ends when all of the green globs have been hit.

Examples of equations to use.

- a) Vertical lines: $y = 2$, $y = -5$
- b) Horizontal lines: $x = -4$, $x = 7$
- c) Sloped lines: $y = 2x - 5$, $y = 3/4x + 6$, $y = -5/3x - 2$
- d) Circles with center (0,0): $x^2 + y^2 = 9$, $x^2 + y^2 = 36$
- Circle with center (2,3): $(x-2)^2 + (y-3)^2 = 16$
- Circle with center (5,1): $(x-5)^2 + (y-1)^2 = 4$
- Circle with center (-2,-1): $(x+2)^2 + (y+1)^2 = 9$

After each game, record your score in the space provided, then press enter to play the next game. Your scores should total at least 100 by the end of the period.

DO NOT SAVE ANY SCORES ON THE DISK! There are not enough disks to do this. If you have a score of over 40 your teacher will save it for you.

<u>GAME #</u>	<u>SCORE</u>	<u>GAME #</u>	<u>SCORE</u>	<u>GAME #</u>	<u>SCORE</u>
1	_____	6	_____	11	_____
2	_____	7	_____	12	_____
3	_____	8	_____	13	_____
4	_____	9	_____	14	_____
5	_____	10	_____	Total	_____

THE FACTORY**Teacher Information**

Reading Level: 7th grade.

Objectives:

To develop problem solving strategies such as working backwards, analyzing a process, and determining the order of a sequence.

To practice strategies of problem solving.

About the Program:

Lesson 1 familiarizes students with The Factory by having them use #1 Testing a Machine from the main menu. The machines are Punch - circle or square (1, 2, or 3 of them), Rotate - 45, 90, 135, or 180 (counter clockwise), and Stripe - thin, medium, or thick. Students are asked to draw the outcome of each machine on their paper.

Lesson 2 begins with the use of #2 Building a Factory from the main menu. Students will predict what the outcome of several machines will look like. Students may use up to eight machines in their predictions. The second part of this lesson involves challenging a partner. One student will build a factory without the other watching. The other student will try to recreate the factory by looking only at the finished product. Students continue to challenge each other as time permits.

Lesson 3 uses #2 Build a Factory then #3 Make a Product from the main menu. Students will predict the product of a factory they are told to build. The second part of this lesson is similar to the challenge section of Lesson 2. Students will start with easy challenges and determine which machines were used to make the product on the screen. As students feel the need for more difficult challenges they may move from easy to medium and hard.

NOTE: The disk does not need to remain in drive A to make selections from the main menu.

THE FACTORY

Name(s) _____

Lesson 1

Objective: To learn what the various machines do in The Factory.

Directions:

1. Choose #1 Testing a Machine from the main menu.
2. Follow the directions on the screen until you have seen how all of the machines work.
3. Fill in the squares below to show what each machine does.

Machine:

Punch

one

two

three

circle

☐☐☐

square

☐☐☐Rotate (draw the square and the position of the arrow).

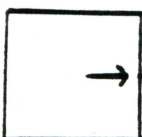
original

45

90

135

180

Does the machine rotate clockwise or counter clockwise?
_____Stripe

thin

medium

thick

☐☐☐

THE FACTORY

Name(s) _____

Lesson 2

Objective: To predict the outcome of the work of a sequence of machines.

Part I. Directions:

1. Choose #2 Building a Factory from the main menu.
2. Select a machine and select what the machine will do. Do this for three machines.
3. Predict what the outcome will look like, then select DONE and press return.

prediction

actual

The screen says: "Do you want to challenge someone?"
Select NO.

4. Build another factory with three machines and draw your prediction before selecting DONE.

prediction

actual

No challenge this time.

5. Build another factory with as many machines as you want (eight is the most). Remember to make a prediction.

Keep building factories until you have two correct predictions, then go to Part II. Use the back if you need more room.

prediction

actual

prediction

actual

prediction

actual

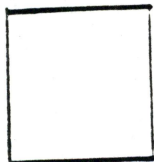
prediction

actual

Part II. Directions:

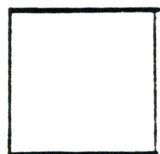
1. One person will build a factory without the other watching. Decide who will go first.
2. Build a factory without the partner watching. (You do not need to predict on this one). Press DONE, return and YES to the question "Do you want to challenge someone?". Draw the challenge below.

The CHALLENGE

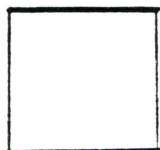


Reverse roles and keep challenging as time permits.

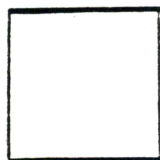
The CHALLENGE



The CHALLENGE



The CHALLENGE



THE FACTORY

Name(s) _____

Lesson 3

Objective: To practice working backwards and analyzing a process to determine a sequence.

Part I. Directions:

1. Select #2 Build a Factory from the main menu.
2. Select these machines then predict what the product will look like before pressing DONE and return.

P=Punch

R=Rotate

S=Stripe

P 2 ●	R 45	S med.	R 90
S thin	P 1 ■	R 90	S thick

prediction

actual

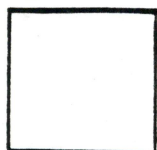
"Do you want to challenge someone?" Select NO.

"Do you want to build another factory?" Select NO.

Part II. Directions:

1. Select #3 Make a Product from the main menu.
2. Start with the "Easy" challenge level.
3. Draw the challenge picture below.
4. In the squares write the machines you used to meet the challenge. Use P for Punch, R for Rotate, and S for stripe.

Easy challenge
picture

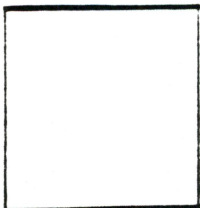


Machines

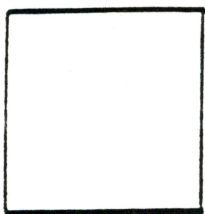
Continued next page.

Continue with the challenges moving to medium and hard as you are ready. Identify the level of the challenge above the picture.

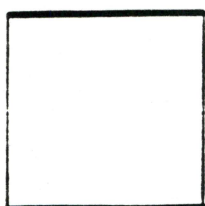
Easy, medium
or hard
Challenge



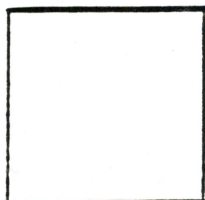
Challenge



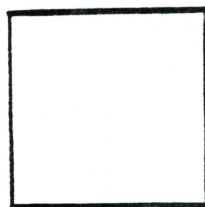
Challenge



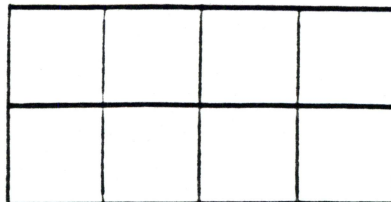
Challenge



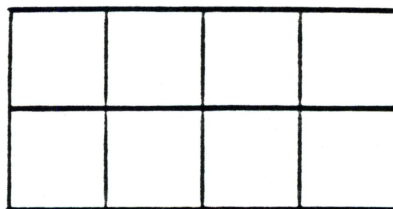
Challenge



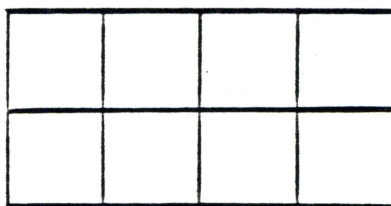
Machines



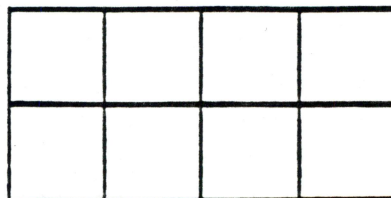
Machines



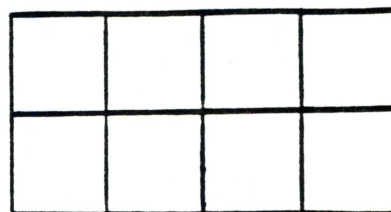
Machines



Machines



Machines



INTERPRETING GRAPHS

Teacher Information

Reading Level: 8th grade.

Objectives:

To practice relating graphs to events.

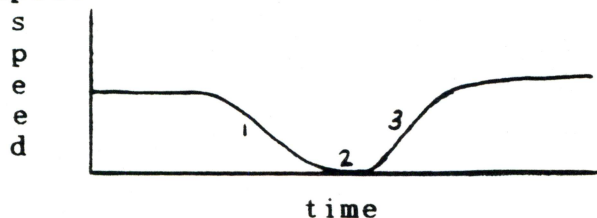
To practice recognition of points in a coordinate plane.

About the Program:

Lesson 1 uses #1 Relating Graphs to Events from the main menu. Students are presented with three curves on a graph and asked which curve fits the given event. An introduction of four graphs is presented to the students (see example at bottom of page). There are twenty graphs in all and students are told how many were answered correctly at the end of the session. This number will be recorded on the student sheet and they will then go back and work the problems that were missed. After students have correctly answered all twenty problems they answer the set of problems on their sheet.

Lesson 2 uses #2 Escape from the main menu. In this game students try to catch robbers by setting up road blocks on a coordinate plane. By typing in a pair of numbers and pressing the return button a vertical blockade is made; a pair of numbers and the space bar a horizontal blockade is made. Choices may be made on the type of clues the students receive. The choices are: 1) the direction the robbers are moving. 2) the distance they are from Main Street, and 3) the angle their movement makes with Main Street. Students will try the different clues and decide which type of clue to play with.

Lesson 1 Example:



Here is a graph showing the speed of a car over a certain period of time.

What part of the graph shows the car speeding up?

>

(Press 1, 2, or 3)

If the student presses 3, it will print Right.

If the student presses a wrong answer it will explain why the answer is wrong and have the student try again.

NOTE: The disk must remain in drive A to make choices from the main menu.

INTERPRETING GRAPHS

Name(s): _____

Lesson 1

Objective: To practice relating graphs to physical relations and events.

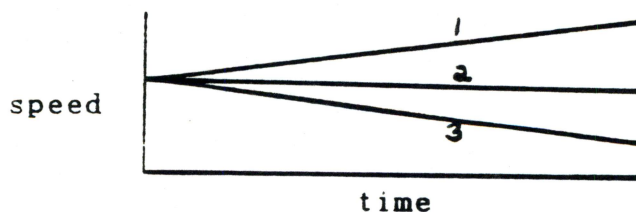
Part I. Directions:

1. Select 0: How to use these programs from the main menu. Follow the directions on the screen until the main menu reappears.
2. Select 1: Relating Graphs to Events from the main menu.
 - a. Press 0 for the introduction.
 - b. At the end of the introduction complete the 20 practice problems.
 - c. When you are finished write the number of correct responses below.
 - d. Retry the missed graphs.

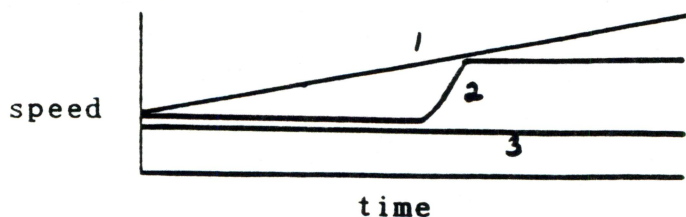
Number of graphs answered correctly. _____

Part II. Directions: Answer the following problems.

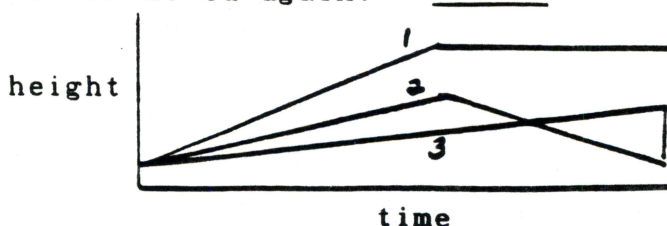
1. Which graph shows the speed of a car as it climbs a steep hill? _____



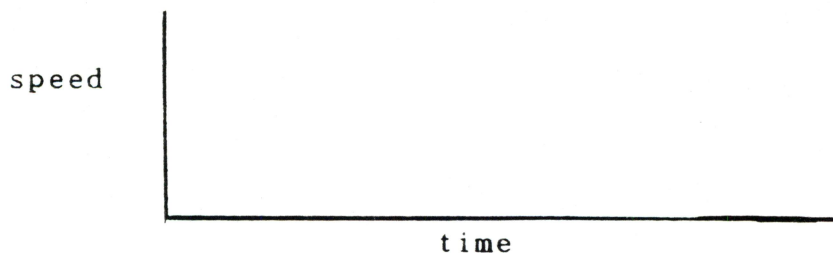
2. Which graph shows a student walking, then running to get to school on time? _____



3. Which graph shows the height of a lawn from the time it gets mowed until it is mowed again? _____

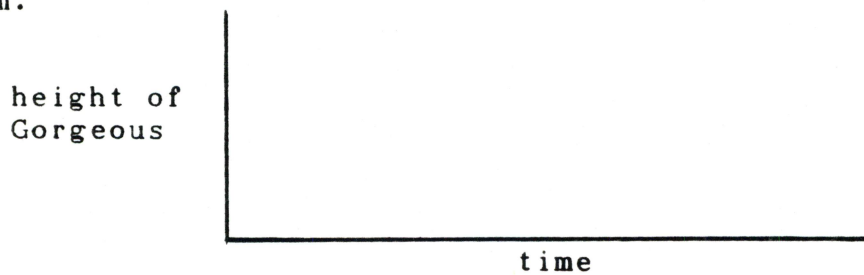


4. Draw a graph of the speed of a car driving down a street and stopping at 3 stop signs.

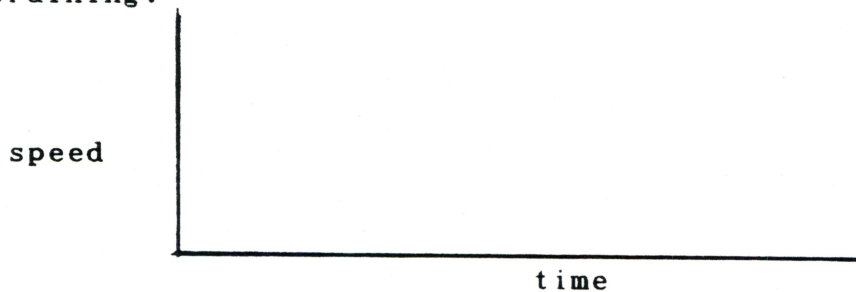


Draw graphs to represent the following situations.

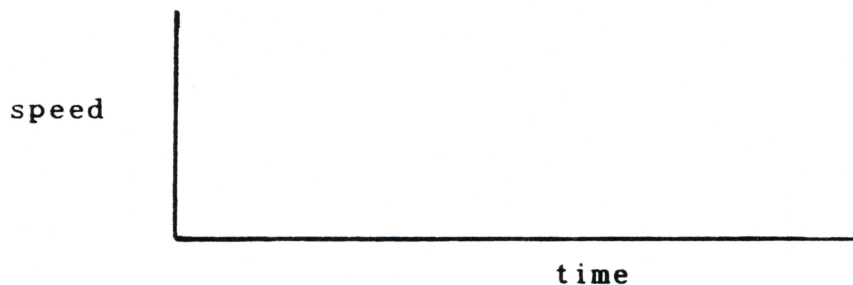
5. Hulk Hogan held Gorgeous George over his head for a few unsteady moments, and then with a violent crash, he dropped him.



6. When biking, I try to start off slowly, build up to a comfortable speed, and then gradually slow as I near the end of my training.



7. Jo had to pull her little brother up a hill in a wagon. When they reached the top Jo got in the wagon and they both rode down the hill.



INTERPRETING GRAPHS

Name(s) _____

Lesson 2

Objective: To practice locating points on a coordinate plane.

Directions:

1. Select #2 Escape from the main menu.
2. Press 0 then Enter to see the rules.
3. After seeing the rules, choose 1: direction robbers are moving.
4. Play the game at least twice under this selection. Then choose 2: distance from Main Street for a few games, and finally choose 3: angle with Main Street for a while.

After trying all three, decide which was the easiest for you to catch the robbers with. Continue playing as time permits. Be sure to take turns at the keyboard.

Which was the easiest for you? (circle your answer)

1. direction robbers are moving.
2. distance from Main Street.
3. angle with Main Street.

**GEOMETRIC SUPPOSER:
TRIANGLES****Teacher Information**

Reading Level: 8th grade.

Objectives:

- To allow students to complete numerous constructions in a limited amount of time.
- To provide the opportunity for students to observe triangle relations and properties and to hypothesize about these relations.

About the program:

Lesson 1 was written to allow students to familiarize themselves with the many menu choices the Geometric Supposer has. You may want to stress to the students that if nothing happens when they want to draw or measure it may be that not enough information has been entered. One letter is not enough to name an angle, they must use all three letters. You may decide to make this lesson more directed by asking them to draw certain things or measure certain things. Time should be allowed for students to do their own thing, whether its 15 minutes or 45.

Lesson 2 requires students to construct specific types of triangles and to measure all the parts of each triangle. A DATA sheet is provided for them to draw the triangles on and to record the measurements of the angles and sides. The questions of this lesson are trying to lead the students to define acute triangle, obtuse triangle, right triangle, and so on.

NOTE: The disk does not need to remain in drive A to make choices from the main menu. Also, I have not used the File option. See the publishers manual if you think you would like to use this option.

**GEOMETRIC SUPPOSER:
TRIANGLES**Name(s) _____

Lesson 1

Objective: To become familiar with using the many menu choices of this software.

Directions: Adjust the circle, press Enter.

1. Press N for new shape. You're on your own.
2. Use as many main menu items as you can.

Check list of Main Menu items.

___ D Draw	___ M Measure	___ R Repeat
___ L Label	___ S Scale change	___ N New shape
___ E Erase	<u>skip</u> F File	<u>skip</u> Q Quit

Any time you want back to the main menu press ESC until the main menu appears.

If you want to start with a new triangle press N from the main menu.

**GEOMETRIC SUPPOSER:
TRIANGLES**Name(s) _____

Lesson 2

Objective: To define types of triangles by studying data collected.

Directions: Adjust the circle, then press Enter.

1. Press N for new shape, and 1 for "Choose type of triangle".
2. Select an acute scalene triangle.
3. Copy the picture on your DATA sheet, then measure the angles and sides using Measure from the main menu.
4. Record the measurements on your DATA sheet.
5. Repeat steps 1-4 for the remaining triangles on your DATA sheet.
6. When you are finished recording all information on the DATA sheet look for similarities among the triangles' measurements. Answer the questions below and on the back of this page according to what you observe on your DATA sheet.

Answer with proper sentences.

Based on the measurements you made:

A. Describe what an isosceles triangle is. _____

B. Describe what an equilateral triangle is. _____

C. Describe what an acute triangle is. _____

D. What is a scalene triangle? _____

E. What is an obtuse triangle? _____

F. What is a right triangle? _____

G. Why can't a right triangle be equilateral? _____

DATA

Name(s) _____
_____DrawingMeasurements

Angles

Sides

Acute scalene	$m\angle ABC =$ $m\angle BAC =$ $m\angle ACB =$	$AB =$ $BC =$ $AC =$
Right scalene		
Obtuse scalene		
Acute isosceles		
Right isosceles		

More on back.

DATA continued

Hint: Not all of these are possible to draw. Think about why not.

<u>Drawing</u>	<u>Measurements</u>	
	Angles	Sides
Obtuse isosceles		
Acute equilateral		
Right equilateral		
Obtuse equilateral		

Conclusion

Based on the review of the literature the use of computers as part of instruction is beneficial in numerous ways and should be a supplement to math instruction. Benefits of CAI include improvement of student attitudes toward computers and subject matter, increased test scores, and less time needed to learn a subject. Cooperation among students and students being an active part of their own learning can also result from computer use in instruction. Students should be allowed to actively participate in their learning and the use of computers in math classes may provide this needed participation.

The lessons provided in this text remain introductory. It can only be hoped that if teachers decide to try the software and lessons available, teachers will decide to continue the use of computers in their math classes. As intended, these lessons give teachers the opportunity, through instructional computing, to help students become competent in the basic skills of computer use as well as afford students the many other potential benefits of CAI.

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